

SECTION 13281

LEAD HAZARD CONTROL ACTIVITIES
04/00

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z9.2 (1979; R 1991) Fundamentals Governing the Design and Operation of Local Exhaust Systems

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM E 1553 (1993) Practice for Collection of Airborne Particulate Lead During Abatement and Construction Activities

ASTM E 1613 (1999) Standard Method for Determination of Lead by Inductively Coupled Plasma Atomic Emission Spectrometry (ICP-AES), Flame Atomic Absorption Spectrometry (FAAS), or Graphite Furnace Atomic Absorption Spectrometry (GFAAS) Techniques

ASTM E 1644 (1998) Practice for Hot Plate Digestion of Dust Wipe Samples for the Determination of Lead

ASTM E 1728 (1995) Field Collection of Settled Dust Samples Using Wipe Sampling Methods for Lead Determination by Atomic Spectrometry Techniques

ASTM E 1729 (1995) Field Collection of Dried Paint Samples for Lead Determination by Atomic Spectrometry Techniques

ASTM E 1741 (1995) Preparation of Airborne Particulate Lead Samples Collected during Abatement and Construction Activities for Subsequent Analysis by Atomic Spectrometry

ASTM E 1792 (1996a) Wipe Sampling Materials for Lead in Surface Dust

CODE OF FEDERAL REGULATIONS (CFR)

29 CFR 1910 Occupational Safety and Health Standards

29 CFR 1926

Safety and Health Regulations for
Construction

40 CFR 745

Lead-Based Paint Poisoning Prevention in
Certain Residential Structures

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 701

(1996; TIA 96-1, 96-2) Methods of Fire
Test for Flame-Resistant Textiles and Films

NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH (NIOSH)

NIOSH Pub No. 84-100

(1984; Supple 1985, 1987, 1988 & 1990)
NIOSH Manual of Analytical Methods

UNDERWRITERS LABORATORIES (UL)

UL 586

(1996; Rev thru Aug 1999) High-Efficiency,
Particulate, Air Filter Units

U.S ARMY CORPS OF ENGINEERS ENGINEERING MANUAL (EM)

EM 385-1-1

(1996) Safety and Health Requirements
Manual

1.2 DEFINITIONS

- a. Lead Hazard Control Activity - Any construction work where a worker may be occupationally exposed to lead and procedures have to be followed to assure that: 1). Lead inside the lead hazard control area is cleaned up to appropriate levels and 2). Lead dust does not disperse outside the lead hazard control area at unacceptable levels.
- b. Industrial Building - Any building used for industrial purposes where normal operations inside the building may produce lead aerosol that will settle out on inside surfaces.

1.3 DESCRIPTION OF WORK

1.3.1 Scope of Work

The LBP abatement work includes the following:

- a. Removal of lead materials indicated for demolition including, but not necessarily limited to, the lead portion of the existing lead joint packing.
- b. Removal of lead-based painted materials indicated for demolition including, but not necessarily limited to, the valve air headers, pneumatic supply piping, valve actuators, conduit, supports and hangers.
- c. Removal of chipping, peeling paint and rust from all previously lead-based painted surfaces in the West Filter Pipe Gallery including, but not necessarily limited to, all piping, valves, operators, supports, hangers, and other appurtenances.

1.3.2 Protection of Existing Areas To Remain

All project work including, but not limited to, lead hazard work, storage, transportation, and disposal shall be performed without damaging or contaminating adjacent work and areas. Where such work or areas are damaged or contaminated, the Contractor shall restore work and areas to the original condition at no additional cost to the Government.

1.3.3 Coordination with Other Work

The contractor shall coordinate lead hazard control activities with work being performed in adjacent areas. Coordination procedures shall be explained in the Contractor's Accident Prevention Plan and shall describe how the Contractor will prevent lead exposure to other contractors and/or Government personnel performing work unrelated to lead hazard control activities.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Materials and Equipment; G|WA
Expendable Supplies; G|WA

A description of the materials, equipment and expendable supplies required; including Material Safety Data Sheets (MSDSs) for material brought onsite to perform the work.

Qualifications; G|WA

A report providing evidence of qualifications and designating responsibilities for personnel and laboratories.

SD-06 Test Reports

Pressure Differential Log; FIO
Licences, Permits, and Notifications; G|WA
Accident Prevention Plan (APP); G|WA

A report describing how the Contractor will protect workers, building occupants, and building contents while performing lead hazard control activities; and how project clearance will be performed.

Sampling and Analysis; G|WA

A log of the analytical results required for the sampling. The log shall be kept current.

Clearance Report; G|WA

Report prepared by the QSHP.

1.5 QUALIFICATIONS

1.5.1 Qualifications and Organization Report

The Contractor shall furnish a qualification and organization report. The report shall describe the qualifications of the qualified safety and health professional (QSHP), onsite safety and health supervisor (OSHS), labor staff and the independent risk assessor. The report shall include an organization chart showing the Contractor's personnel by name and title and project specific responsibilities and authorities. The report shall describe the qualifications of the laboratories selected for this project. The report shall be signed by the Contractor and the qualified safety and health professional to indicate that all personnel and laboratories comply with certification and experience requirements of this section and that project personnel have been given the authority to complete the tasks assigned to them. Certification that the Contractor has at least two (2) years prior experience on LBP abatement projects similar in nature and extent to ensure the capability to perform the abatement in a satisfactory manner. Contractor shall submit a copy of their employee's current certificates and licenses for lead abatement.

1.5.2 Personnel and Subcontractor Responsibilities and Qualifications

1.5.2.1 Qualified Safety and Health Professional (QSHP)

The QSHP shall be responsible for development of project specific requirements in the Accident Prevention Plan (APP); supervise implementation of the APP requirements; visit the site as needed to verify effectiveness of the APP and to coordinate resolution of unknown situations that may develop as the work progresses; be available to provide consultation to the Onsite Safety and Health Supervisor (OSHS); review sampling and analytical results to evaluate occupational exposure levels, verify effectiveness of controls and determine if clearance requirements have been met. The QSHP shall have demonstrable experience with the implementation of occupational safety and health regulations.

1.5.2.2 Lead Hazard Control Workers

Lead Hazard Control workers shall be responsible for performing the labor necessary to complete the lead hazard control activities required in this contract.

1.5.2.3 Independent Certified Risk Assessor

The independent Certified Risk Assessor shall be a subcontractor to the prime Contractor on the project. The risk assessor shall be responsible to perform the sampling and evaluating the analytical data to verify clearance levels have been achieved. The independent risk assessor shall sign the clearance report indicating clearance requirements for the contract have been met.

1.5.2.4 Testing Laboratories

The laboratory selected to perform analysis on paint chip, soil or dust wipe samples shall be accredited by EPA's National Lead Laboratory Accreditation Program (NLLAP). The laboratory selected perform analysis on worker exposure (industrial hygiene) samples shall be in the American Industrial Hygiene Association's Industrial Hygiene Laboratory

Accreditation Program (IHLAP) and shall be successfully participating in the Proficiency Analytical Testing (PAT) program for lead.

1.5.2.5 Blood Lead Testing

The laboratory selected to perform analysis on worker blood samples shall be approved by OSHA and meet the requirements contained in http://www.osha-slc.gov/OCIS/toc_bloodlead.html.

1.5.2.6 Disposal Facility and Transporter

The Contractor shall furnish written evidence that the disposal facility and/or landfill to be used is approved for lead disposal by federal, state, and local environmental requirements and regulations. The Contractor shall segregate, pack, label, mark, placard, manifest, and transport all hazardous wastes according to all applicable OSHA, EPA and DOT regulations.

Copies of all manifests, Bills of Lading, and Certificates of Disposal shall be provided to the Contracting Officer.

1.6 REGULATORY REQUIREMENTS

In addition to the detailed requirements of this specification, work shall be performed in accordance with requirements of EM 385-1-1 and applicable regulations including, but not limited to 29 CFR 1910, 29 CFR 1926, especially Section .62, and the accepted Accident Prevention Plan with Appendices. Matters of interpretation of the standards shall be resolved to the satisfaction of and with the concurrence of, the Contracting Officer before starting work. Where these requirements vary, the most stringent shall apply. The following State and local statutes, regulations and requirements apply to lead hazard control activities to be performed: State, Maryland, Local Montgomery County.

1.7 ACCIDENT PREVENTION PLAN (APP)

1.7.1 APP Content and Organization

The Contractor's Accident Prevention Plan shall be organized into 5 parts, consisting of the overall plan and 4 appendices. The overall plan shall address each element in Appendix A of EM 385-1-1 in project specific detail. The elements are: a. Signature Sheet, b. Background Information, c. Statement of Safety and Health Policy, d. Responsibilities and Lines of Authorities, e. Subcontractors and Suppliers, f. Training, g. Safety and Health Inspections, h. Safety and Health Expectations, Incentive Programs and Compliance, i. Accident Reporting, j. Medical Support, k. Corporate Plans and Programs required by this contract, (HAZCOM, Respiratory Protection).

1.7.1.1 Lead Hazard Control Plan Appendix

The Lead Hazard Control Appendix shall address occupational exposure issues and shall describe the procedures to be followed to protect employees from lead hazards while performing lead hazard control activities. Each of the following elements shall be addressed in the lead hazard control appendix:

- a. The location and a brief description of each work activity that will emit lead into the workplace atmosphere. A description of any components containing lead shall be included and keyed to the project drawings.

- b. Description of equipment and materials, controls, crew size, worker responsibilities, and operating and maintenance procedures.
- c. Description and sketch of the Lead Hazard Control Areas, including decontamination areas.
- d. Description of the specific lead control methods and procedures to protect workers and other onsite contractors from lead exposure.
- e. Technologic equipment used to keep occupational exposure below the Permissible Exposure Limit and minimize worker exposure to lead (i.e., HEPA-filtered vacuum equipment/cleaners, special negative air enclosure equipment and supplies, etc.).
- f. Worker Exposure Assessment including methods and procedures to monitor and document worker exposure to lead. Worker exposure monitoring shall be broken into two parts in the plan. Part A: Initial Determination. The Contractor shall describe worker monitoring (if performed for the "initial determination" described in 29 CFR 1926 (.62) (d). Monitoring for the initial determination may be omitted from the plan if the Contractor has sufficient proof from previous operations as specified in 29 CFR 1926 (.62) (d)(3)(iii) and (iv) that workers will not be exposed over the action level. The Contractor shall substitute objective proof of action level compliance in Part A if "initial determination" monitoring is omitted. Part B: Continued Exposure Monitoring. Worker exposure monitoring after the initial lead exposure determination has been made.
- g. Work Practices Program describing the protective clothing to be used to protect workers from lead exposure, house keeping procedures employed to minimize spread on lead contamination in the lead hazard control area, hygiene facilities and practices used to prevent workers from inadvertent ingestion of lead.
- h. Administrative Control Procedures, to be used as a last resort, to limit worker exposure to lead. The worker rotation schedule to be employed, should engineering or personal protective equipment precautions fail to be effective, shall be described. This element of the plan shall be omitted if administrative controls will not be used.
- i. Medical Surveillance practices and procedures used to monitor worker exposure to lead and to assure fitness for wearing respiratory protection devices.
- j. Worker training meeting the requirements of 29 CFR 1926 Sections (.62) and (.59) to assure workers understand hazard associated with working with lead and how to protect themselves.
- k. Security: Barriers for each lead hazard control area. Entry into lead hazard control areas shall only be by personnel authorized by the Contractor and the Contracting Officer. Persons entering control areas shall be trained, medically evaluated, and equipped with personal protective equipment required for the specific control area to be entered.

1.7.1.2 Activity Hazard Analyses Appendix

An Activity Hazard Analysis (AHA) shall be prepared for each work task data element specified on the individual work task data element sheets at the end of this section. The AHA shall be submitted to the Contracting Officer prior to beginning specified work. Format shall be in accordance with EM 385-1-1, figure 1-1. The AHA shall be continuously reviewed and modified, when appropriate, to address changing conditions or operations. Each accepted AHA shall be appended to and become part of the APP.

1.7.1.3 Occupant/Building Protection Plan Appendix

The Contractor shall develop and implement an Occupant/Building Protection Plan describing the measures and management procedures to be taken during lead hazard control activities to protect the building occupants/building facilities (and future building occupants/facilities) from exposure to any lead contamination while lead hazard control activities are performed.

1.7.1.4 Clearance Plan Appendix

The Contractor shall develop a Clearance Plan describing practices and procedures used to assure that lead hazard control activities are complete and that lead contamination within the lead hazard control area comply with final clearance levels or visual clearance criteria. Sampling and analysis procedures used to document project completion and clearance goals shall be explained in the Clearance Plan Appendix.

1.8 PRE-CONSTRUCTION SAFETY CONFERENCE

1.8.1 Conference General Requirements

The Contractor and the QSHP shall attend a pre-construction safety conference prior to starting work. Items required to be submitted shall be reviewed for completeness, and where specified, for acceptance. Details of the APP shall be revised to correct any deficiencies, and resubmitted for acceptance. Commencement of on-site work shall not begin until all submittals by the lead-based paint Contractor are approved, all permits received, all work coordinated with Washington Aqueduct, and the Contracting Officer approves the starting date. One copy of the APP shall be maintained in the Contractor's jobsite file, and a second copy shall be posted where it will be accessible to personnel on the site. As work proceeds, the APP shall be adapted to new situations and conditions. Changes to the APP shall be made by the QSHP with acceptance by the Contracting Officer. Should an unforeseen hazard become evident during performance of the work, the QSHP shall inform the Contracting Officer, both verbally and in writing, for immediate resolution. In the interim, the QSHP shall take necessary action to re-establish and maintain safe working conditions; and to safeguard onsite personnel, visitors, the public, and the environment. Disregard for provisions of this specification, or the accepted APP, shall be cause for stopping of work until the matter is rectified.

1.8.2 Preparatory Inspection Meeting

The Contractor shall arrange and hold a preparatory inspection meeting to review completeness and adequacy of the APP immediately prior to beginning each phase of work.

1.9 MEDICAL SURVEILLANCE REQUIREMENTS

The Contractor shall comply with the following medical surveillance requirements:

- a. The Contractor shall make every attempt to keep occupational exposure to lead on this project below the action level of 30 micrograms/cubic meter defined in 29 CFR 1926 (.62). If it is not possible, and if occupational exposures could possibly exceed the action level for 30 or more days per year, the Contractor shall institute a medical surveillance program. The program shall meet the examination frequency and content requirements specified in paragraph (j)(1), (j)(2) and (j)(3) of 29 CFR 1926 (.62). Medical removal as specified in paragraph (k) of 29 CFR 1926 (.62), if necessary, shall be at the Contractor's expense.
- b. Medical surveillance and biological monitoring shall be in compliance with 29 CFR 1926 (.62) (g) and (j). Initial biological monitoring shall be performed on lead hazard control workers prior to assignment to the project. Workers shall not be assigned to the project if results indicate a need for restricted activities.
- c. All lead hazard control workers shall pass the medical examinations necessary to be approved by the occupational physician to wear respiratory protection on this project. Occupational physician's approval shall be given prior to assignment to the project.

1.10 RESPIRATORY PROTECTION PROGRAM

The Contractor shall have a written respiratory protection program and shall be fully capable of implementing the requirement of the respiratory protection program on this project. The respiratory protection program shall meet the requirements of 29 CFR 1926 (.62) and 29 CFR 1910 (.134). Project specific respiratory protection requirements shall be included in the lead hazard control plan appendix of the Contractor's Accident Prevention Plan.

1.11 LICENCES, PERMITS AND NOTIFICATIONS

The Contractor shall certify in writing to the Regional Office of the EPA, state's environmental protection agency responsible for lead hazard activities, and the Contracting Officer at least 10 days prior to the commencement of work that all licenses, permits and notifications have been obtained. The Contractor is responsible for all associated fees or costs incurred in obtaining the licenses, permits and notifications.

1.12 TRAINING

1.12.1 OSHA Training Requirements

All Contractor personnel and/or subcontractors performing or responsible for onsite oversight of lead hazard control activities shall meet the following training requirements.

- a. Content of 29 CFR 1926 (.62) and its appendices.
- b. How operations could result in exposure over the action level.

- c. Purpose, selection, fitting, use and limitations of respirators.
- d. Purpose and description of the medical surveillance program.
- e. Use of engineering controls and good work practices to limit occupational exposure to lead.
- f. Implementation of the lead hazard control plan appendix of the accident prevention plan.
- g. Medical supervision for the use of chelating agents.
- h. Employee right of access to medical surveillance records as specified in 29 CFR 1910 (.20).

1.12.2 Qualified Safety and Health Professional

The qualified safety and health professional shall meet the training requirements in paragraph 1.12.1 and shall meet the training, experience and authority requirements in 29 CFR 1926 (.62) to be a competent person and be trained and have the experience and education to meet 40 CFR 745 Subpart L requirements to carry the following certifications:

- a. Certified Risk Assessor.
- b. Certified Project Designer.
- c. Certified Supervisor.

1.12.3 Independent Risk Assessor

The independent risk assessor shall meet the training requirements in paragraph OSHA Training Requirements, above, and shall meet the training and experience requirements in 40 CFR 745 to carry certification as a certified risk assessor.

1.12.4 Abatement Worker

Workers shall meet the OSHA Training Requirements specified above and the training requirements in 40 CFR 745 Subpart L to carry certification as a Certified Worker, if required.

1.12.5 Training Program Certification

Training to meet 40 CFR 745 Subpart L requirements shall be provided by an EPA accredited training provider and the Contractor shall provide proof in the Qualifications and Organization Report showing that personnel have passed certification examinations for their respective disciplines, that fees for certification have been paid to the EPA (or to the state for state-run programs) and that EPA has certified the QSHP, independent risk assessor, certified workers to perform their duties.

1.13 SAMPLING AND ANALYSIS

1.13.1 Sampling and Analytical Procedures

1.13.1.1 Sampling and Analysis Methods

Analysis shall conform to NIOSH Pub No. 84-100 Method 7082, Lead, for

personal sampling required by 29 CFR 1926 (.62) and ASTM E 1613. Sampling shall conform to ASTM E 1553 and ASTM E 1741.

1.13.1.2 Paint Chip Sampling and Analysis

Sampling shall conform to ASTM E 1729. Analysis shall conform to ASTM E 1613.

1.13.1.3 Dust Wipe Materials, Sampling and Analysis

Sampling shall conform to ASTM E 1792, ASTM E 1728 and ASTM E 1644. Analysis shall conform to ASTM E 1613.

1.13.2 Occupational Exposure Assessment

Sampling and analytical procedures to determine compliance with the occupational exposure monitoring requirement of this section shall be described in the lead hazard control plan appendix of the Contractor's accident prevention plan. Monitoring for the initial determination may be omitted if the Contractor has sufficient proof from previous operations as specified in 29 CFR 1926 (.62) (d) (3) (iii) and (iv) that workers will not be exposed over the action level. The following occupational exposure monitoring requirements apply and shall be implemented if the requirements of 29 CFR 1926 (.62) (d) (3) (iii) and (iv) cannot be demonstrated.

- a. During Initial Monitoring the Contractor shall representatively sample employees with the greatest potential for exposure to aerosolized lead.
- b. Continued/Additional Monitoring shall meet applicable paragraphs in 29 CFR 1926 (.62) (d) (6), Frequency, after the initial determination has been made.

1.13.3 Lead Hazard Control Area/Containment Monitoring

The Contractor shall perform a visual inspection once per day outside the lead hazard control area to assure visual clearance criteria are maintained while lead hazard control activities are performed. The Contractor shall clean at its own expense, and to the Contracting Officer's satisfaction, all contaminated surfaces outside the lead hazard control area, if surfaces fail visual clearance criteria.

1.13.4 Occupancy During Work

The Contractor shall wipe sample a floor surface at a location no more than 10 feet outside the lead hazard control area at a frequency of once per day while lead hazard control activities are being performed. Wipe sampling analytical results shall pass clearance criteria for floors specified in this contract. The Contractor shall clean all contaminated surfaces at its own expense and to the Contracting Officer's satisfaction, if floor wipe samples required in this paragraph fail clearance criteria.

1.13.5 Clearance Monitoring

Sampling and analytical procedures to determine the clearance requirements of this section shall be described by the Contractor in the Clearance Plan Appendix of the Accident Prevention Plan. In accordance with federal, state and local regulations, sampling and analytical procedures to determine the clearance requirements shall be described by the Contractor

in the Clearance Plan. If required by regulations, the Contractor shall perform the sampling and analysis as required by the regulations to verify that clearance requirements for the contract (inside the lead hazard control) area have been met.

1.13.6 Waste Disposal Sampling

The Contractor shall sample the following waste streams for TCLP analysis to determine waste disposal requirements.

- a. The Contractor shall take 5 samples of demolition debris.
- b. The Contractor shall take 5 samples of paint chips.

1.13.7 Analytical Results

The Contractor shall develop and maintain during the course of the project a log of analytical results generated by the above sampling requirements. The log shall clearly describe the reason for which the sample was taken (worker exposure, migration control, clearance) the analytical result for each sample and evaluate if the analytical result passed or failed the action levels. At a minimum, the Contractor shall include analytical results for samples required to be taken in paragraphs Occupational Exposure Assessment, Lead Hazard Control Area/Containment Monitoring, Occupancy During Work, and Clearance Monitoring specified above.

1.14 CLEARANCE REQUIREMENTS

The Contractor shall describe clearance requirements for this project in the Clearance Plan Appendix of the Accident Prevention Plan.

- a. Clear lead hazard control areas in industrial facilities: visual clearance criteria and in accordance with the most stringent state or local requirements.

1.15 PERSONAL PROTECTIVE EQUIPMENT (PPE)

The Contractor shall describe the PPE to be used to protect workers from lead hazards in the Lead Hazard Control Plan Appendix of the Accident Prevention Plan. The Contractor shall furnish, at no cost to the workers, clothing for protection from lead-contaminated dust and debris. An adequate supply of these items shall be available for worker and Government personnel use. Protective clothing shall include:

- a. Coveralls : Full-body moisture permeable (breathable) disposable coveralls shall be provided to lead hazard control workers.
- b. Boots: Boots and shoes shall be provided as required by EM 385-1-1 Section 05.A.08 for workers. Boot/shoe covers shall be provided to prevent contamination of boots and shoes.
- c. Hand Protection: Gloves, etc., shall be provided as required by EM 385-1-1 Section 05.A.10 for workers.
- d. Head Protection: Hard hats shall be provided as required by 29 CFR 1910 (.135) and EM 385-1-1 Section 05.D for workers and authorized visitors.

- e. Eye and Face Protection: Eye and face protection shall be provided as required by 29 CFR 1910 (.133) and EM 385-1-1 Section 05.B for workers and authorized visitors.
- f. Respirators: NIOSH certified air-purifying respirators or filtering face pieces shall be provided for use as respiratory protection for airborne lead and for other hazardous airborne contaminants that may be encountered; as determine by the on-site safety and health supervisor. At a minimum, respirators shall be furnished to each employee required to enter a lead hazard control area where an employee exposure assessment has not yet been performed, or where monitoring data establishes the need for respiratory protection, or if requested by the employee.
- g. Respirator Cartridges/Filtering Face Pieces: Respirator cartridges shall be changed out/filtering face pieces properly disposed of when the they become sufficiently loaded with particulate matter that workers experience breathing resistance. Cartridges and filtering face pieces shall be N, R or P 100 rated to assure sufficient protection from lead exposure.

1.16 HYGIENE FACILITIES

The Contractor shall describe the personal hygiene facilities to be used by the workers in the Lead Hazard Control Plan Appendix of the Accident Prevention Plan. The Contractor shall provide hygiene facilities for lead hazard control workers. Hygiene facilities shall consist of the following:

1.16.1 Hand Wash Stations

The Contractor shall provide hand washing facilities for use by lead hazard control workers. Hand washing facilities shall comply with the requirements in 29 CFR 1926 (.51) (f). Faces and hands shall be washed when leaving the lead hazard control area and after each work-shift if showers are not provided.

1.16.2 Change Area

The Contractor shall provide a change area to workers. The change area shall be equipped so that contaminated work clothing and street clothes shall be stored separately to prevent cross contamination.

1.16.3 Showers

Showers shall be provided if feasible and if worker exposures exceed the PEL. When provided, showers facilities shall meet the requirements of 29 CFR 1926 (.51) (f).

1.16.4 Eating Area

The Contractor shall set aside an area or provide a room for taking breaks and eating lunch. This area shall be kept as free as practicable from lead contamination. Workers shall be required to follow the procedures in 29 CFR 1926 (.62) (i) (4) when using the room.

1.17 POSTED WARNINGS AND NOTICES

The following regulations, warnings, and notices shall be posted at the worksite in accordance with 29 CFR 1926 (.62).

1.17.1 Regulations

At least two copies of 29 CFR 1926 (.62) shall be made available for use by either the Contracting Officer or affected workers; and for the purpose of providing required information and training to the workers involved in the project. One copy shall be maintained in the Contractor's jobsite file, and a second copy shall be posted where it will be accessible to workers on the site.

1.17.2 Warning Signs and Labels

Warning signs shall be posted in each lead hazard control area where worker exposure to lead is undetermined or where the exposures are above the permissible exposure limit as defined in 29 CFR 1926 (.62). Signs shall be located to allow personnel to read the signs and take necessary precautions before entering the lead hazard control area.

1.17.2.1 Warning Signs

Warning signs shall be in English and Spanish, be of sufficient size to be clearly legible, and display the following:

WARNING
LEAD WORK AREA
POISON
NO SMOKING OR EATING

1.17.2.2 Warning Labels

Warning labels shall be affixed to all lead waste disposal containers used to hold materials, debris and other products contaminated with lead hazards; warning labels shall be in English and Spanish, and be of sufficient size to be clearly legible, and display the following:

CAUTION: CLOTHING CONTAMINATED WITH LEAD. DO NOT REMOVE DUST BY
BLOWING OR SHAKING. DISPOSE OF LEAD CONTAMINATED WASH WATER IN
ACCORDANCE WITH APPLICABLE FEDERAL, STATE OR LOCAL REGULATIONS.

1.17.3 Worker Information

Right-to-know notices shall be placed in clearly visible areas accessible to personnel on the site, to comply with Federal, state, and local regulations.

1.17.4 Air Monitoring Results

Air monitoring results shall be prepared so as to be easily understood by the workers. One copy shall be maintained in the Contractor's jobsite file, and a second copy shall be posted where it will be accessible to the workers as specified in 29 CFR 1926 (.62).

1.17.5 Emergency Telephone Numbers

A list of emergency telephone numbers shall be posted at the site. The list shall include numbers of the local hospital, emergency squad, police and fire departments, Government and Contractor representatives who can be

reached 24 hours per day, and professional consultants directly involved in the project.

1.18 MATERIALS AND EQUIPMENT

Sufficient quantities of health and safety materials required by 29 CFR 1926 (.62), and other materials and equipment needed to complete the project, shall be available and kept on the site.

1.18.1 Abrasive Removal Equipment

The use of powered machine for vibrating, sanding, grinding, or abrasive blasting is prohibited unless equipped with local exhaust ventilation systems equipped with high efficiency particulate air (HEPA) filters.

1.18.2 Negative Air Pressure System

1.18.2.1 Minimum Requirements

Work shall not proceed in the area until containment is set up and HEPA filtration systems are in place. The negative air pressure system shall meet the requirements of ANSI Z9.2 including approved HEPA filters per UL 586. Negative air pressure equipment shall be equipped with new HEPA filters, and shall be sufficient to maintain a minimum pressure differential of minus 0.02 inch of water column relative to adjacent, unsealed areas. Negative air pressure system minimum requirements are listed below:

- a. The unit shall be capable of delivering its rated volume of air with a clean first stage filter, an intermediate filter and a primary HEPA filter in place.
- b. The HEPA filter shall be certified as being capable of trapping and retaining mono-dispersed particles as small as 0.3 micrometers at a minimum efficiency of 99.97 percent.
- c. The unit shall be capable of continuing to deliver no less than 70 percent of rated capacity when the HEPA filter is 70 percent full or measures 2.5 inches of water static pressure differential on a magnehelic gauge.
- d. The unit shall be equipped with a manometer-type negative pressure differential monitor with minor scale division of 0.02 inch of water and accuracy within plus or minus 1.0 percent. The manometer shall be calibrated daily as recommended by the manufacturer.
- e. The unit shall be equipped with a means for the operator to easily interpret the readings in terms of the volumetric flow rate of air per minute moving through the machine at any given moment.
- f. The unit shall be equipped with an electronic mechanism that automatically shuts the machine off in the event of a filter breach or absence of a filter.
- g. The unit shall be equipped with an audible horn that sounds an alarm when the machine has shut itself off.
- h. The unit shall be equipped with an automatic safety mechanism that

prevents a worker from improperly inserting the main HEPA filter.

1.18.2.2 Auxiliary Generator

An auxiliary generator shall be provided with capacity to power a minimum of 50 percent of the negative air machines at any time during the work. When power fails, the generator controls shall automatically start the generator and switch the negative air pressure system machines to generator power. The generator shall not present a carbon monoxide hazard to workers.

1.18.3 Vacuum Systems

Vacuum systems shall be suitably sized for the project, and filters shall be capable of trapping and retaining all mono-disperse particles as small as 0.3 micrometers at a minimum efficiency of 99.97 percent. Used filters that are being replaced shall be disposed in a proper manner.

1.18.4 Heat Blower Guns

Heat blower guns shall be flameless, electrical, paint-softener type with controls to limit temperature to 1,100 degrees F. Heat blower shall be DI (non-grounded) 120 volts ac, and shall be equipped with cone, fan, glass protector and spoon reflector nozzles.

1.18.5 Chemical Paint Strippers

Chemical paint strippers shall not contain methylene chloride and shall be formulated to prevent stain, discoloration, or raising of the substrate materials.

1.18.6 Chemical Paint Stripper Neutralizer

Neutralizers for paint strippers shall be compatible with the substrate and suitable for use with the chemical stripper that has been applied to the surface.

1.18.7 Detergents and Cleaners

Detergents or cleaning agents used shall have demonstrated effectiveness in lead control work using cleaning techniques specified by HUD-01 guidelines.

1.19 EXPENDABLE SUPPLIES

1.19.1 Polyethylene Bags

Disposable bags shall be polyethylene plastic and shall be a minimum of 6 mils thick (4 mils thick if double bags are used) or any other thick plastic material shown to demonstrate at least equivalent performance; and shall be capable of being made leak-tight. Leak-tight means that solids, liquids or dust cannot escape or spill out.

1.19.2 Polyethylene Leak-tight Wrapping

Wrapping used to wrap lead contaminated debris shall be polyethylene plastic that is a minimum of 6 mils thick or any other thick plastic material shown to demonstrate at least equivalent performance.

1.19.3 Polyethylene Sheeting

Sheeting shall be polyethylene plastic with a minimum thickness of 6 mil, or any other thick plastic material shown to demonstrate at least equivalent performance; and shall be provided in the largest sheet size reasonably accommodated by the project to minimize the number of seams. Where the project location constitutes an out of the ordinary potential for fire, or where unusual fire hazards cannot be eliminated, flame-resistant polyethylene sheets which conform to the requirements of NFPA 701 shall be provided.

1.19.4 Tape and Adhesive Spray

Tape and adhesive shall be capable of sealing joints between polyethylene sheets and for attachment of polyethylene sheets to adjacent surfaces. After dry application, tape or adhesive shall retain adhesion when exposed to wet conditions, including amended water. Tape shall be minimum 2 inches wide, industrial strength.

1.19.5 Containers

When used, containers shall be leak-tight and shall be labeled in accordance with EPA, DOT and OSHA standards, as specified in paragraph WARNING LABELS.

1.19.6 Chemicals

Chemicals, including caustics and paint strippers, shall be properly labeled, used in accordance with the manufacturers recommendations and stored in leak-tight containers. Material Safety Data Sheets (MSDSs) shall be provided and hazard communication procedures implemented in conformance with paragraph HAZARD COMMUNICATION PROGRAM.

1.20 STORAGE OF MATERIALS

Materials shall be stored protected from damage and contamination. During periods of cold weather, plastic materials shall be protected from the cold. Flammable or hazardous materials shall not be stored inside a building. Materials shall be regularly inspected to identify damaged or deteriorating items. Damaged or deteriorated items shall not be used and shall be removed from the site as soon as they are discovered. Stored materials shall not present a hazard or an inconvenience to workers, visitors, and/or other occupants and employees of the facility in which they are located.

PART 2 PRODUCTS

NOT APPLICABLE

PART 3 EXECUTION

3.1 WORK PROCEDURES

The Contractor shall perform work following practices and procedures described Accident Prevention Plan.

3.1.1 Lead Hazard Control Areas, Equipment and Procedures

The Contractor shall set up lead hazard control areas and operate equipment within the lead hazard control area in a manner that will minimize migration of lead dust beyond the lead hazard control area boundaries and minimize exposure to workers.

3.1.2 Lead Hazard Control Areas

Access into lead hazard control areas by the general public shall be prohibited. The Contractor shall coordinate LBP work with Washington Aqueduct and Contracting Officer to ensure parts of the West Filter Pipe Gallery are not shutdown during critical periods. Workers entering the lead hazard control area shall meet medical surveillance requirements of this contract and shall be required to understand and follow procedures described in the Contractor's Accident Prevention Plan for reducing lead exposure. Lead hazard control area preparation and restriction requirements follow:

- a. Containment features for interior lead hazard control projects:
Polyethylene sheeting sealed with spray adhesive and duct tape.
Colored caution tape to designate the lead hazard control area.
The floor in the lead hazard control area shall be covered with two layers of polyethylene sheeting. The entry/exit shall be sealed with a primitive air lock.

3.1.3 Negative Air Pressure System Containment

- a. The negative air pressure systems shall be operated to provide at least 10 air changes per hour inside the containment. The local exhaust unit equipment shall be operated continuously until the containment is removed. The negative air pressure system shall be smoke tested for leaks at the beginning of each shift. The OSHS is responsible to continuously monitor and keep a pressure differential log with an automatic manometric recording instrument. The Contracting Officer shall be notified immediately if the pressure differential falls below the prescribed minimum. The building ventilation system shall not be used as the local exhaust system for the lead hazard control area utilizing the negative air pressure system. The local exhaust system shall terminate out of doors unless the Contracting Officer allows an alternate arrangement. All filters shall be new at the beginning of the project and shall be periodically changed as necessary to maintain specified pressure differential and shall be disposed of as lead contaminated waste.
- b. Discontinuing Negative Air Pressure System. The negative air pressure system shall be operated continuously during lead hazard control work unless otherwise authorized by the Contracting Officer. At the completion of the project, units shall be run until full cleanup has been completed and final clearance testing requirements have been met. Dismantling of the negative air pressure systems shall conform to written decontamination procedures, be approved by the Contracting Officer, and be as presented in the Lead Hazard Control Plan. The HEPA filter machine intakes shall be sealed with polyethylene to prevent environmental contamination.

3.2 USE OF HYGIENE FACILITIES

- a. Personnel and equipment shall be decontaminated when exiting the lead hazard control area. The Contractor shall comply with the following personnel and equipment decontamination procedures:
 - (1) HEPA vacuum outer garments and equipment.

- (2) Wet Wipe Equipment.
 - (3) Remove outer layer of garments.
 - (4) Thoroughly wash face and hands, if showering not required.
 - (5) Shower (if applicable).
 - (6) Remove Respirator (if applicable).
 - (7) Exit lead hazard control area.
- b. The Contractor shall provide, and workers shall use, a change room to change into work clothing at the beginning of a work shift. At the end of the work shift workers shall change back into street clothing and leave contaminated work clothing at the site for disposal or laundering.
- c. The Contractor shall provide an eating facility as free as practical from lead contamination. Workers shall be allowed usage of the eating facility for rest/lunch breaks.

3.3 WASTE DISPOSAL PROCEDURES

3.3.1 Construction Debris and/or Sanitary Landfill Waste

The Contractor shall dispose of the following waste streams in a sanitary landfill: Used Personal Protective Equipment and disposable material from containment structures.

3.3.2 Waste Stream Classification

The Contractor shall determine the RCRA waste classification for all waste streams generated by the lead hazard control project. The Contractor shall perform the sampling and analysis specified in paragraph WASTE DISPOSAL, evaluate analytical results and propose waste stream treatment and disposal requirements for the contract. The Contracting Officer will approve waste stream treatment and disposal requirements proposed by the Contractor.

3.3.3 RCRA Subtitle C Hazardous Waste

The Contractor shall dispose of the following waste streams at the RCRA subtitle C Treatment Storage and Disposal Facility or at the RCRA subtitle C hazardous wastes landfill: Lead debris from removed joint packings, dust and paint chips from HEPA vacuuming operations, and paint sludge and residue from chemical or heat stripping procedures. All remaining items coated with lead-based paint shall be disposed of by the Contractor in accordance with all federal, state and local regulations. Contractor shall notify Contracting Officer 48 hours prior to shipment so that Contracting Officer can sign all manifests. Hazardous wastes generated by Contractor shall be stored on-site for no longer than 90 days.

3.3.4 Hazardous Waste Transportation and Disposal

The Contractor shall transport, treat and dispose of hazardous waste [in accordance with the requirements of Section 02120 TRANSPORTATION AND DISPOSAL OF HAZARDOUS MATERIALS] [_____].

3.4 LEAD HAZARD CONTROL PROCEDURES, METHODS AND TECHNIQUES.

3.4.1 Surface Refinishing

Surfaces to be painted to control lead hazards shall be prepared and painted in accordance with the following requirements.

3.4.1.1 Painted Surfaces

Painted Surfaces shall be treated in accordance with Section 09900 PAINTING, GENERAL.

3.4.2 Paint Removal Methods

Prohibited paint removal methods shall include: open flame burning or torching, including the use of heat guns having operating temperatures greater than 1,100 degrees F; machine sanding or grinding without HEPA exhaust; non-contained hydro blasting or high-pressure water wash; abrasive blasting or sandblasting without HEPA exhaust; dry scraping, except near electrical outlets or when using a heat gun. Chemical paint removers containing methylene chloride are prohibited. Building components and structures adjacent to the removal process shall be appropriately protected from damage due to the removal process employed. Stripping shall be done according to manufacturer's recommendations. Stripped substrates shall be thoroughly washed and neutralized before applying a primer or sealing coat.

3.4.2.1 Low Temperature Heat Gun

Prior to beginning work, electrical fuses and adequate electrical supply shall be verified. Only fuses properly sized for the service, and otherwise permitted by code, shall be used. Properly sized fuses shall not be changed out with larger fuses to increase amperage beyond safe limits. Portable electric generators may be used to safely supply adequate amperage. An accessible garden hose with a pressure-release spray nozzle; a crowbar to remove smoldering wood; and a long-handled sledgehammer to open up walls exposed to smoldering insulation shall be readily available. A fully charged ABC-type (20 pound minimum) fire extinguisher shall be available within 100 feet of the work area. Adequate ventilation shall be provided for the work area. Worker protection shall include respirators equipped with combination HEPA filter/organic vapor cartridges. The Contractor shall equip heat guns with extension tubes or wire mesh as needed to prevent premature burnout of the heating elements and to minimize paint film scorching or smoking. Optimal heat gun/substrate separation is typically 3 to 6 inches. Paint residue and wastes shall be handled in accordance with the Contractor's Hazardous Waste Management Plan procedures.

3.4.2.2 HEPA Sanding

The HEPA vacuum shall be correctly sized to provide adequate airflow, permitting the system to operate properly. If longer exhaust hoses are used, a larger HEPA vacuum shall be provided to handle the extra pressure drop in the vacuum hose. The HEPA filter shall be operated in accordance with manufacturer's instructions. Worker protection shall include respirators or filtering facepieces equipped with HEPA filters. Paint residue and wastes shall be handled in accordance with the Contractor's Hazardous Waste Management Plan procedures.

3.4.2.3 Wet Scraping

Surfaces near electrical outlets shall not be moistened but shall be dry scraped only. Loose material shall be scraped from the surface and deposited onto the containment plastic. Damp scrapings shall be cleaned up as soon as possible to prevent tracking throughout the work area. Scraper blades shall be kept sharp. Additional scraper blades shall be supplied and shall be selected for the type of surface being scraped. Paint residue

and wastes shall be handled in accordance with the Contractor's Hazardous Waste Management Plan procedures.

3.4.2.4 HEPA Vacuum Blasting

The blast head shall be shrouded under a vacuum and exhaust passed through a HEPA filter. The blast head shall remain in continuous contact with the surface to avoid dispersal of both the blast medium and particulate. The equipment shall be equipped with a device that separates the blast media from the material to be removed, effectively recycling the blast material and minimizing the amount of waste. Work shall be positioned to minimize the degree workers must reach above shoulder level, in order to minimize worker fatigue and loss of blast head contact with the surface. Paint residue and wastes shall be handled in accordance with the Contractor's Hazardous Waste Management Plan procedures.

3.4.2.5 HEPA Vacuum Needle Gun

The vacuum needle gun head shall be equipped with a vacuum shroud designed for the surface to be treated. The needle gun shall be operated to maximize surface contact of the vacuum shroud. Work shall be positioned to minimize the degree workers must reach above shoulder level, in order to minimize worker fatigue and loss of needle gun contact with the surface.

3.4.2.6 Onsite Paint Removal

Paint remover shall be applied in accordance with the manufacturer's instructions. Outdoor application shall only be performed in weather conditions recommended by the manufacturer. The work area surrounding the application process shall be secured to prevent access by unauthorized personnel. Workers shall be provided with the appropriate personal protective clothing and equipment in accordance with manufacturer's recommendations and good industrial hygiene practice. A portable eyewash shall be provided whenever eye irritant strippers are used. An abundant source of running water shall be provided in the work area by the Contractor and in accordance with all federal, state, and local safety regulations. The stripper shall be tested in a small area prior to full scale stripping. Caustic strippers shall not be used on aluminum or glass surfaces. Waste disposal shall be in accordance with paragraph WASTE DISPOSAL PROCEDURES. Stripped surfaces shall be neutralized and washed in accordance with manufacturer's instructions and paragraph CHEMICAL PAINT STRIPPER NEUTRALIZER. Stripped surfaces shall be completely dry before repainting, and shall be repainted only with paints proven compatible with the stripping techniques employed. Paint residue and wastes shall be handled in accordance with the Contractor's Hazardous Waste Management Plan procedures.

3.5 CLEARANCE PROCEDURES

3.5.1 Visual Inspection

QSHP and Contracting Officer shall perform a visual inspection, using the form at the end of this section, for each lead hazard control area to assure that lead hazard control activities, identified in the individual work task data elements, have been properly completed. The QSHP shall visually verify that lead hazards have been removed, control technology has been appropriately applied/installed and that the lead hazard control area is free of dust and paint chips generated by lead hazard control activities.

3.5.2 Analytical Demonstration of Clearance

If required by federal, state, or local regulations, the independent risk assessor shall, following visual inspection, take clearance samples for laboratory analysis to verify clearance requirements specified in paragraph CLEARANCE REQUIREMENTS have been met.

3.6 EVALUATION OF SAMPLING AND MONITORING RESULTS

Analytical results from samples taken during lead hazard control activities shall be evaluated to determine compliance with occupational safety and health standards and project specific control efficiency and clearance/clean up levels.

3.6.1 Occupational Safety and Health

The QSHP shall review the analytical results from samples taken for the initial exposure assessment and continued occupational safety and health monitoring if required. Effectiveness and adequacy of personal protective equipment, respirators, work practices, hygiene facilities and personal decontamination procedures shall be evaluated and upgrades/downgrades in equipment and procedures made. After notifying the Contracting Officer the following shall be applied:

- a. Exposures over the PEL (0.05 mg/cubic meter):
 - (1) Improve work practices to reduce exposures.
 - (2) Don respirators.
 - (3) Assure eating facilities and change rooms are clean and are free from settled dust.
 - (4) Shower as part of personal decontamination.
- b. Exposures over the Action Level (0.03 mg/cubic meter):
 - (1) Assure exposed individuals enrolled in the medical surveillance program.
 - (2) Assure exposed individuals enrolled in and up to date with lead exposure training requirements.

3.6.2 Control Efficiency of Containment Features

The QSHP shall review and document results of the visual inspection determining visual clearance criteria are being met while lead hazard control activities are being performed. The QSHP shall review analytical results from samples taken to determine if lead is migrating outside lead hazard control areas at levels in excess of clearance criteria. The QSHP shall notify the Contracting Officer and apply the following actions if results exceed project specific clearance levels outside the lead hazard control area:

- a. Require/improve containment.
- b. Improve work practices to reduce lead aerosol generation.

3.6.3 Clearance

The QSHP shall review analytical results for the samples taken to determine compliance with project specific clearance requirements. The following actions apply and shall be performed at the Contractor's expense if project specific clearance levels are exceeded:

Reclean surfaces.
Retest to determine clearance.

3.6.4 Removal of Lead Hazard Control Area

Upon acceptance of the final clearance certification by the Contracting Officer, and when authorized, cleared Lead Hazard Control Area boundary controls and warning signs shall be removed.

3.7 CLEARANCE REPORT

The QSHP shall prepare a clearance report including the following information:

- a. Start and completion dates of lead hazard control activities.
- b. Type of lead hazard control activity performed (i.e., abatement, interim control, renovation, remodeling), locations and lead hazards controlled or abated.
- c. The name and address of each firm conducting lead hazard control activities and the name of each supervisor assigned to the project.
- d. The Occupant Protection Plan prepared pursuant to paragraph OCCUPANT PROTECTION PLAN.
- e. The name, address and signature of the QSHP or independent risk assessor to indicate clearance requirements have been met.
- f. Certification of each Final Cleaning and Visual Inspection performed by the QSHP.
- g. Analytical results from clearance sampling performed by the QSHP or independent risk assessor, the name of the laboratory that conducted the analysis. Results shall be provided in both the laboratory report and on the appropriate example forms provided at the end of this section.
- h. A detailed written description of the lead hazard control activities performed, including hazard control methods used, locations of rooms and/or components where lead hazard control activities occurred, reason for selecting particular hazard control methods for each component, and any suggested monitoring of encapsulants or enclosures.
- i. Hazardous waste disposal documentation.

3.8 TITLE TO MATERIALS

Materials resulting from demolition work, except as specified otherwise, shall be come the property of the Contractor, and shall be disposed of in accordance with Section 02220 DEMOLITION, except as specified.

3.9 PAYMENT FOR HAZARDOUS WASTE

Payment for disposal of hazardous waste will not be made until a signed copy of the manifest and a Certificate of Disposal from the treatment or disposal facility certifying the amount of lead-containing materials delivered is returned and a copy is furnished to the Government.

3.10 CERTIFICATION OF VISUAL INSPECTION

Certify that the lead hazard control area(s) for each individual work task data elements have passed visual clearance criteria and are ready for clearance sampling. To pass visual clearance, lead hazards have to be removed; control technology appropriately applied/installed; the lead hazard control area must be free from visible dust debris, paint chips or any other residue that may have been generated by the lead hazard control activities.

Signature by the QSHP indicates that the described lead hazard control area(s) have passed visual clearance criteria. Provide detailed description of each Lead Hazard Control Area.

BY: _____
QSHP _____ Date _____

Print name and title _____

CONTRACTING OFFICER ACCEPTANCE OR REJECTION

The Contracting Officer hereby determines that the Contractor has performed visual inspection of the lead hazard control area and by quality assurance inspection, finds the Contractor's work to be:

_____ Acceptable, ready for performance of clearance sampling

_____ Unacceptable, Contractor instructed to re-clean the lead hazard control area

BY: Contracting Officer's Representative

Signature _____ Date _____

Print name and title _____

Lead Hazard Control Clearance Sampling Certification Form

Date _____

Name of QSHP or Certified Risk
Assessor _____

License No. _____

Work Task Data Element _____

Clearance Levels _____
40 CFR 745 Clearance Levels

Sample quantity and location:

Windows _____

Floors _____

Exterior Soils _____

Date of sample collection _____ Date Shipped to lab _____

Shipped by _____
Signature

I certify that the clearance samples taken meet the clearance sampling

requirements of this contract.

By: _____ Date: _____
QSHF or independent risk assessor

Print name and Title: _____

CONTRACTING OFFICER ACCEPTANCE OR REJECTION

I have inspected sampling locations and procedures and have found them to be
_____ Acceptable, meet contract requirements.

_____ Unacceptable, do not meet contract requirements, Contractor is
directed to resample.

By: Contracting Officer's Representative

Signature _____ Date _____

Print Name and Title _____

INDIVIDUAL WORK TASK DATA ELEMENTS

Sheet _____ of _____

There is a separate data sheet for each individual work task.

WORK TASK DESIGNATION NUMBER: _____

2. LOCATION OF WORK TASK:

3. BRIEF DESCRIPTION OF THE LEAD HAZARD CONTROL ACTIVITY:

4. POST LEAD HAZARD CONTROL BUILDING/FACILITY USE: INDUSTRIAL

5. LEAD CONTAMINATED DEBRIS DISPOSAL DESTINATION: RCRA subtitle C Landfill

6. CLEARANCE REQUIREMENTS: VISUAL

-- End of Section --

APPENDIX

APPENDIX A

Lead-Based Paint Test Results

AMERICAN MEDICAL LABORATORIES, INC.®

P.O. Box 10841 • 14225 Newbrook Drive
Chantilly, VA 20153-0841
Telephone: (703) 802-6900 • (800) 336-3718

RECEIVED

AUG 23 2001

MALCOLM PIRNIE

NEWPORT NEWS

ROUTE:

17585 U.S. ARMY CORPS OF ENGINEERS

PATTY GAMBY/WASH. AQUEDUCT DIV

5900 MACARTHUR BLVD. NW

WASHINGTON

20715

JOB #

FILE:

INDUSTRIAL HYGIENE DEPARTMENT

PAGE 1

RECEIVED : 01/20/2001

RELEASED : 01/20/2001

REPORTED : 01/21/2001

WORK ORDER: 169006

PROJECT NAME/JOB ID: NOT PROVIDED

AML NUMBER-----VALUE-----UNITS-----

8740992 103-PAG Bulk
3330 LEAD IN PAINT
Concentration: 0.030 % Lead
QUANTITATION LIMIT: 0.010 % Lead
Analyst: Earl Callender

8740993 104-PAG Bulk
3330 LEAD IN PAINT
Concentration: 0.034 % Lead
QUANTITATION LIMIT: 0.0094 % Lead
Analyst: Earl Callender

8740994 105-PAG Bulk
3330 LEAD IN PAINT
Concentration: Less than quantitation limit.
QUANTITATION LIMIT: 0.0094 % Lead
Analyst: Earl Callender

8740995 106-PAG Bulk
3330 LEAD IN PAINT
Concentration: 13.7 % Lead
QUANTITATION LIMIT: 0.010 % Lead
Analyst: Earl Callender

NOTATIONS

Analysis for lead in paint is performed via modified EPA 846-3050 with subsequent analysis by flame atomic absorption spectroscopy (FLAA) or Inductively Coupled Plasma-Atomic Emission Spectroscopy (ICP-AES).

As per "Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing", Department of Housing and Urban Development (HUD), June, 1995, the regulatory limit by which a paint film is determined to be Lead-Based is either 0.5% by weight or 1.0 milligrams per square centimeter (mg/cm²).

Excess backing material such as wallboard or wood submitted as sample may cause a result to appear lower than is actually correct for results reported in weight
CONTINUED ON NEXT PAGE

AMERICAN MEDICAL LABORATORIES, INC.®

P.O. Box 10841 • 14225 Newbrook Drive
Chantilly, VA 20153-0841
Telephone: (703) 802-6900 • (800) 336-3718

INDUSTRIAL HYGIENE DEPARTMENT

PAGE 2

DD

RECEIVED : 01/20/2001 17585 U.S. ARMY CORPS OF ENGINEERS
RELEASED : 01/20/2001 PATTY GAMBY/WASH. AQUEDUCT DIV
REPORTED : 01/21/2001 5900 MACARTHUR BLVD., NW
WORK ORDER: 169006 WASHINGTON, DC
20315

PROJECT NAME/JOB ID: NOT PROVIDED

AML NUMBER-----VALUE-----UNITS-----
CONTINUED FROM PRIOR PAGE
percent.

Where results are reported with a less than symbol (<), no measureable level of Lead (Pb) was determined for the specific sample in question. The concentrations reported are calculated using the weight of a homogeneous portion of the sample submitted, or the entire weight of the sample submitted where necessary.

The current Reporting Limit (RL) for Lead (Pb) in paint analysis is 15 micrograms (ug). Given a sample aliquot of 100 milligrams, the concentration Quantitation Limit (QL) calculates as 0.015%.

*** FINAL REPORT ***

CHRISTOPHER KASE
DIRECTOR, IND. HYGIENE

FOR INDUSTRIAL HYGIENE RELATED QUESTIONS,
INCLUDING REQUESTS FOR SUPPLIES, CALL
1-800-348-1590

SECTION 13621

INSTRUMENTATION AND CONTROL SYSTEMS
GENERAL PROVISIONS

PART 1 GENERAL

1.1 SCOPE OF WORK

1.1.1 Provide all labor, materials, equipment and incidentals as shown, specified and required to furnish, install, calibrate and place in operation a complete Supervisory Control and Data Acquisition (SCADA) System for the West Filter Building. Systems shall be of the type as specified and as shown.

1.1.2 The scope of work shall include the following:

1.1.2.1 All monitoring and control instruments as shown and specified herein.

1.1.2.2 Panels: Two filter control Local Operator Panels (LOP1 and LOP2), two filter Digital Process Controller Panels DF 27-35 (odd filters) and DF 28-36 (even filters).

1.1.2.3 Purge air system as shown and specified herein.

1.1.2.4 Software modifications to the existing Bristol Babcock host DPC DMM1 Cabinet. Modifications shall meet requirements of Section 13660. Modifications to DM2 communication links per Sec. 1.2.1.2.1. Staging of all modification is to be coordinated with Plant Operations.

1.1.2.5 Configuration of the existing Central SCADA System to monitor, store, display and log process and equipment operating information and alarms and to perform various process control functions and to generate various reports.

1.1.2.6 The Contractor shall furnish all labor, materials and equipment necessary for interfacing all monitoring and control signals under this Contract with the existing instrumentation control system specified and installed under all previous Contracts.

1.1.2.7 All hardware and I/O points shall be completely configured including graphical representation, trending, alarming, logging, reporting and control programming as specified herein and as required to match the level of detail at the existing PMCs.

1.2 INTERFACE BETWEEN NEW AND EXISTING SYSTEMS

1.2.1 The interface between the West Filter Building SCADA System (WFB-SCADA) and the existing Central SCADA System shall be seamless via a data highway from DF 27-35 (odd filters) and DF 28-36 (even filters) to the existing master remote telemetry cabinet, DMM1, located in the Control Room. DF 27-35 (odd filters) and DF 28-36 (even filters) will be daisy-chained to DMM1 (via DM2) as shown on the Drawings.

1.2.2 The conduit and cable linking all the new panels together and to the existing DMM1 cabinet is specified under Division 16.

1.2.3 Configure the data highway in order to write to, and read from, the DPC Panels provided as part of the CONTRACT as necessary to achieve the functionality specified. The Contracting Officer's Representative shall

provide the SUPPLIER with a complete soft copy of existing ACCOL program in DMM1 cabinet for their use. The WFB-SCADA system shall be completely functional when the link to the Central SCADA System is down. The DPC panels shall retain the last setpoint and commands from the Central SCADA System. The Process and Instrumentation Diagrams (P&IDs) on the Contract drawings show the design for the system and the interface with equipment. The drawings show the anticipated inputs and outputs to the system and the routing of logic through the DPCs. The P&IDs show I/O points at DF 27-35 (odd filters) and DF 28-36 (even filters). Control Description is included in Section 13660 which describe the requirements for graphics and the logic functionality.

1.3 QUALITY ASSURANCE

1.3.1 General

1.3.1.1 The WFB-SCADA System shall be furnished by a single Supplier who shall assume responsibility for providing a complete and integrated system.

1.3.1.2 All equipment, components and materials specified under Instrumentation and Control Systems (sections 13621 through 13660) shall be furnished by the single Supplier who shall assume the responsibility for adequacy and performance of all items.

1.3.1.3 The Supplier shall identify those system components which are not of its manufacture.

1.3.1.4 The Supplier shall supply its quality assurance plan, and for components which are not of its manufacture, the component manufacturer's quality assurance plan. The plans shall include but not necessarily be limited to: method of testing, raw material criteria, methods of documentation, station control, "Burn-In", final tests and serialization coding and packaging. Said plans shall be in accordance with M.I.L.-105D.

1.3.1.5 Bristol Babcock is the preferred manufacturer of the WFB-SCADA system components.

1.3.2 Pre-Award Performance Requirements: Prior to recommending award, the successful bidder, if proposing equipment other than Bristol Babcock, as described in Bid Item #0001, shall demonstrate compatibility of his equipment with the existing Dalecarlia Water Treatment Plant system, as specified herein. The demonstration shall be performed at the Dalecarlia Water Treatment Plant. The demonstration shall consist of but not necessarily be limited to, the following:

1.3.2.1 For the following demonstrations a minimum of ten digital and ten analog signals shall be used for communication verification.

- a. Proposed equipment shall demonstrate successful communication between the Contractor-supplied workstations and the existing server (DMM1). The communication link shall demonstrate successful access of real time and historic data.
- b. Proposed equipment shall demonstrate successful communication between the Contractor-supplied filter DPCs and the existing server (DMM1). The communication link shall demonstrate successful access of real time data.
- c. To successfully demonstrate compatibility, communications updates for the above listed demonstrations between the existing equipment and the Contractor-supplied equipment shall not take more than three seconds.

1.3.2.2 The apparent low bidder must successfully perform the Pre-Award Performance Requirements within 30 days after the bids are opened.

1.3.2.3 The demonstration shall be conducted on-site and shall be witnessed by the Contracting Officer's Representative and Washington Aqueduct operations staff. The cost of performing the Pre-Award Performance Requirements shall be included in the Contractor's base bid. There shall be no additional cost to the Government.

1.3.3 Supplier's Qualifications: Supplier shall:

1.3.3.1 Be a financially sound firm having at least five years continuous experience in designing, implementing, supplying and supporting instrumentation and control systems which are comparable to the Process Control System in terms of hardware, software, cost and complexity.

1.3.3.2 Have manufactured and supported standard lines of digital processing and control equipment and application software continuously for the last five years.

1.3.3.3 Have in existence at the time of bid advertisement, an experienced engineering and technical staff capable of designing, implementing, supplying and supporting the Process Control System and handling the Process Control System submittal and training requirements.

1.3.3.4 Provide system hardware components and software packages of fully developed, field proven standardized designs.

1.3.3.5 Have a minimum of two years experience in hardware application and programming of distributed microprocessor based controllers and data highway systems.

1.3.3.6 Have a thorough working knowledge of water treatment processes and control philosophy in accordance with standard practices of the water treatment industry.

1.3.3.7 Have a system of traceability of the manufactured units and purchased components through production, assembly and testing.

1.3.3.8 Have a system of "Burn-In" for all components and available supportive documentation.

1.3.3.9 Have a demonstrated record of prompt response to field failures.

1.3.3.10 Have a documented program of failure analysis.

1.3.3.11 Have proof of compliance with UL standards for panels.

1.3.3.12 Have a record of prompt shipments in accordance with contract obligations required for previous projects.

1.3.4 Supplier's Responsibility

1.3.4.1 Contractor shall retain the WFB-SCADA System Supplier to undertake the responsibilities specified below. However, execution of these specified duties by the system Supplier shall not relieve Contractor of the ultimate responsibility for the system.

- a. Design, fabrication, implementation and applications programming of the WFB-SCADA system and all subsystems in accordance with the Contract Documents and all referenced standards and codes.

- b. Preparation, assembly and correction of all WFB-SCADA system monitoring and control system submittals in accordance with the Contract Documents.
- c. Proper interfacing of the WFB-SCADA System hardware, software, and panels, including required interfacing with equipment furnished by other Suppliers, and with the plant electrical system.
- d. Supervision of the installation of WFB-SCADA System, instruments, panels, cabinets, wiring and other components required.
- e. Calibration, testing and start-up of the WFB-SCADA System.
- f. Training of Government personnel in operation and maintenance of the monitoring and control system.
- g. Handling of all warranty obligations for the monitoring and control system components.
- h. Maintenance of two reproducible copies of the complete system and running software at the Supplier's facility for the duration of the warranty period. Software copies shall be maintained on the bulk storage medium used by the Supplier for system program development and shall be directly loadable on the supplied system.

1.3.5 Reference Standards

1.3.5.1 The following organizations have generated standards that are to be used as guides in assuring quality and reliability of components and systems; govern nomenclature; define parameters of configuration and construction, in addition to specific details in this Specification and the Contract Drawings:

- a. ISA, Instrument Society of America.
- b. UL, Underwriters' Laboratories, Inc.
- c. AWWA, American Water Works Association.
- d. NEMA, National Electrical Manufacturers Association.
- e. OSHA, Occupational Safety and Health Administration.
- f. ANSI, American National Standards Institute.
- g. MIL, Military Standards.
- h. NFPA, National Fire Protection Association.
- i. SAMA, Scientific Apparatus Manufacturers Association.
- j. JIC, Joint Industrial Council.
- k. IEEE, Institute of Electrical and Electronic Owners.
- l. NEC, National Electrical Code.

1.4 COORDINATION AND PROGRESS MEETINGS

1.4.1 Routine progress and coordination meetings will be scheduled by Contracting Officer's Representative. The system Supplier shall be required to attend a minimum of two meetings.

1.4.2 The purpose of the meetings shall be to review the progress of the Work involving the WFB-SCADA System and provide coordination for installation of the equipment to ensure construction schedules are met.

1.4.3 Representatives at the meetings shall have the competence and authority to make any and all necessary decisions. Decisions and statements made at the meetings shall commit system Supplier to agreed procedures and schedules.

1.5 SUPPLIER PROJECT PERSONNEL

1.5.1 The system Supplier shall provide the following project personnel:

1.5.1.1 Project Manager:

- a. The system Supplier shall appoint a project manager who shall coordinate and schedule all work and assure that project schedule is met.
- b. The project manager shall act as the liaison with Contractor for the installation of the WFB-SCADA System equipment and shall assist in all matters required for proper coordination and interfacing of the equipment and processes.

1.5.1.2 Field Engineer:

- a. The system Supplier shall appoint a field Engineer with responsibilities as follows:
 - 1) Provide advice and technical consultation relative to installation techniques and procedures for equipment furnished.
 - 2) Installed system checkout, calibration, adjustment and start-up including tuning of every control loop.
 - 3) Maintenance services during availability demonstration.
 - 4) Involvement in the on-site system training of plant personnel.
 - 5) Resolving of control problems encountered during initial start-up and testing of all plant monitoring and control equipment.
- b. The field Engineer shall have a minimum of five years experience in systems control and start-up and shall have a thorough working knowledge of both the hardware and software supplied for the plant monitoring and control system.

1.6 SUBMITTALS

Governmental approval is required for submittals with a "GA" designation; submittals having a "FIO" designation are for information only. The

following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES.

SD-01, Data

Supplier Qualifications; GA|AE

Submit a Technical Proposal from the Supplier proposed to provide the WFB-SCADA System. The proposal shall be complete and contain all information as specified below.

1. Financial Statement: Include the value of distributed microprocessor based control systems delivered during the last two fiscal years. Also include the value of other process instrumentation and controls shipped during the period.
2. Experience:
 - a. Provide evidence of compliance with the specific experience requirements listed in Paragraph 1.3.2 above in the form of an experience certification signed by an officer of the company.
 - b. Describe at least three completed projects utilizing instrumentation and control equipment identical to or similar to (indicate which) that specified. Indicate Owner, value, completion date, names and phone numbers of Owner's representatives familiar with each project. Letters of recommendation may be submitted.
 - c. Furnish list of last ten projects completed.
3. Personnel: Provide a listing of those personnel committed to be assigned to the project. List shall include project manager, project engineer, field representative, local service representative, and sales representative. Indicate addresses of personnel not based at Supplier's main office. Provide documentation including resumes of personnel demonstrating experience in water treatment applications.
4. Exceptions: List all exceptions and deviations from the requirements of the Specifications. Reference section number, article, and paragraph of proposed variance and provide an explanation of why the proposed substitution meets (or exceeds) the functional or equipment requirements specified.
5. Shipment Records: Provide evidence of timely delivery of equipment on past projects.
6. Panel Mounted Devices and Field Instruments: Provide descriptive literature and catalog cuts for each type of devices required by the project.
7. Training: Provide information on the qualifications of the factory training staff.
8. Maintenance: Provide the following information:
 - a. Location of service facility along with minimum and maximum response time.
 - b. Location of parts facility with delivery time and method.

Pre-Submittal Conference Data; FIO

Supplier shall prepare the items listed below for presentation at the pre-submittal conference. The information shall be submitted to Government three weeks prior to the date of the conference.

- a. List of equipment and materials required and the brand and model which Supplier proposes to use for each item.
- b. List of proposed exceptions to the plans and specifications along with a brief explanation of each. Approval shall be subject to a formal submittal.
- c. Sample of each type of submittal specified herein. These may be submittals prepared for other projects.
- d. A flow chart showing the steps to be taken in preparing and coordinating each control system submittal, and a list of proposed submittals.
- e. Bar chart type schedule for monitoring and control system related activities from the pre-submittal conference through start-up and training. Particular emphasis shall be given to dates relative to submittals, design, fabrication, programming, factory testing, deliveries, installation and field testing. The schedule shall be subdivided to show activities relative to each major item or group of items when everything in a given group is on the same schedule.
- f. General outline of the type of tests to be performed to verify that all sensors/transducers, instruments and digital processing equipment are functioning properly.

WFB-SCADA System Information; GA|AE

Supplier shall submit a system information package in accordance with the following:

- a. System Description:
 - 1) Detailed block diagram showing system hardware configuration and identifying model numbers of system components.
 - 2) Software language and organization.
 - 3) Format, protocol and procedures for data highway communications and local communications with input/ output modules and peripheral devices.
 - 4) Man-machine interfacing details.
 - 5) Control and failure modes.
 - 6) On-line and off-line capabilities for programming, system utilities and diagnostics.
 - 7) Input/output point listing with I/O module cross reference identification for each DPC.
 - 8) Data base listing including all input/output points.

- 9) Suggested detailed format and configuration of all log reports, alarm summaries, printer outputs and CRT and OIT displays and graphics.
 - 10) List of spare parts and test equipment.
- b. Equipment Hardware:
- 1) Layout drawings showing front, rear, end and plan views to scale of all processing equipment, I/O components, power supplies and peripheral devices.
 - 2) Construction details, features and procedures.
 - 3) Interconnection diagrams including termination details, cable identification list and cable length.
 - 4) Plans showing equipment layout in control panels.
 - 5) Installation requirements, instructions and/or recommendations.
- c. Software Description:
- 1) Standard technical documentation covering all aspects of the monitoring and control system software functions and capabilities, including instruction set description and programming procedures related to control, monitoring, display, logging, reporting and alarming functions.
 - 2) Standard technical and instructional documentation covering software for utility, system support, system documentation, display, communications, data logging and storage and diagnostic functions.
 - 3) Detailed functional descriptions of application programs explaining control, display, logging and alarming features to be provided and functions to be performed.
 - 4) Documentation describing memory type, size and structure and listing size of system memory, I/O and Data Table memory and size of memory available for control programs. Also define estimated control program memory requirements and processor execution times and program scan times.
 - 5) Documentation describing central monitoring station main and secondary memory types, size and requirements to perform the display, logging, reporting and alarming functions required, as associated with the WFB-SCADA system.

Panels and Cabinets Information; GA|AE

Supplier shall submit a system information package in accordance with the following:

- a. Layout Drawings, include the following:
- 1) Front, rear, end and plan views to scale.
 - 2) Dimensional information.

- 3) Tag number and functional name of components mounted in and on panel, console or cabinet.
 - 4) Product information on all panel components.
 - 5) Nameplate location and legend including text, letter size and colors to be used.
 - 6) Location of anchoring connections and holes.
 - 7) Location of external wiring and/or piping connections.
 - 8) Mounting and installation details.
 - 9) Proposed layouts and sizes of graphic display panels.
- b. Wiring and/or piping diagrams, include the following:
- 1) Name of panel, console or cabinet.
 - 2) Wiring sizes and types.
 - 3) Piping sizes and types.
 - 4) Terminal strip numbers.
 - 5) Color coding.
 - 6) Functional name and manufacturer's designation for components to which wiring and piping are connected.
- c. Electrical control schematics in accordance with JIC standards.
- d. Plan showing equipment layout in each area.

WFB-SCADA System I/O Loop Wiring Diagrams; GA/AE

Supplier shall prepare drawings on a module-by-module basis and include the following information:

- a. Rack numbers, slot number, module type and module terminal point numbers. Also include location and identification of all intermediate panel terminal block and strip numbers to which I/O wiring and power supply wiring is connected. Identify all power supply circuit numbers and ratings.
- b. Wiring sizes, types, wire numbers and color coding.
- c. Location, functional name, tag numbers and manufacturer model numbers of panel and field devices and instruments to which I/O wiring is connected. For discrete I/O devices use JIC electrical symbols tagged with designation shown on the Contract Drawings.

System Software Documentation; FIO

1. Supplier shall prepare and submit two copies of preliminary software documentation at least four weeks prior to expected initiation of factory testing as specified in Section 13622. Submittal shall be for information only and shall not be subject to formal approval. Software documentation shall include the following as a minimum:

- a. Complete hard copies of all ACCOL or approved equal programming. Documentation shall include complete external and internal I/O coil, contact and signal cross referencing. Documentation shall clearly distinguish between internal and real I/O.
- b. Complete listing of preset constant values along with functional point descriptions.
- c. Complete hard copies of all program documentation for all types of programs.
- d. Complete database listing including listings for log, report and alarm file setups.
- e. Hard copies of all system graphic displays and formats for all logs, reports and the alarm summary.
- f. User's manuals describing procedures and providing examples for use of operator's consoles, workstations and programming terminal, accessories and system utility routines to perform control, display and logging program generation, program modification, program verification, diagnostics, program documentation, loading and backup and other required system support functions.

2. Graphic Displays: Submit samples of each type of display.

SD-18, Records

Record Drawings and Documentation; FIO

Supplier shall prepare and submit the following:

- a. Supplier shall revise all system Shop Drawings, submittals and software documentation to reflect as-built conditions in accordance with the requirements of the Contract Documents and the supplemental requirements below.
- b. Six copies of all revised Shop Drawings and documentation shall be submitted to the Government to replace out-dated drawings and documentation contained in the System O&M Manuals. Half-size black line sets shall be provided for all drawings larger than 11x17. Specific instructions for out-dated drawing removal and replacement shall be provided with the record drawing submittal.
- c. Half-size black line prints of wiring diagrams applicable to each control panel shall be placed inside a clear plastic envelope and stored in a suitable print pocket or container inside each control panel and console.

SD-19, Operation and Maintenance Manuals

WFB-SCADA System Operation and Maintenance Manuals; GA|WA

Furnish O&M manuals for the WFB-SCADA System in accordance with the Specification Section 13630 and the supplemental requirements below:

- a. The O&M manuals shall include the following:
 - 1) Name, address and telephone number of the control system Supplier's local service representative.

- 2) Complete list of supplied system hardware parts with full model numbers referred to system part designations, including spare parts and test equipment provided.
- 3) Copy of all approved submittal information and system shop drawings as specified herein with corrections made to reflect actual system as tested and delivered to the site for installation. Half-size black line reproductions shall be provided for all shop drawings larger than 11 by 17 inches.
- 4) Complete up-to-date system software documentation.
- 5) Manufacturer's original copies of hardware, software and installation, assembly and Operations Manuals for the WFB-SCADA System's DPC Panels, LOP Panels, Local Compressor Control Panel and all other control system components. Manuals shall include the following information:
 - a) General descriptive information covering the basic features of the equipment.
 - b) Physical description covering layout and installation requirements and all environmental constraints.
 - c) Functional and operational descriptions covering the procedures for programming, operation, start-up, shutdown, and calibration of the control system equipment and explaining how the various control functions are performed.
 - d) Principles of operation explaining the logic of operation; provide information covering operation to a component level.
 - e) Maintenance procedures covering checkout, troubleshooting, and servicing; checkout procedures shall provide the means to verify the satisfactory operation of equipment, troubleshooting procedures shall serve as a guide in determining faulty components and servicing procedure shall cover requirements and recommended time schedule for calibration, cleaning, lubrication and other housekeeping and preventive maintenance procedures.
 - f) Wiring, schematic and logic diagrams.
 - g) Safety considerations relating to operation and maintenance procedures.

1.7 PRE-SUBMITTAL CONFERENCE

1.7.1 Contractor shall arrange and conduct a pre-submittal conference on the control system within 30 days of notification of preliminary acceptance of the proposed Supplier.

1.7.2 Contractor shall allot one full working day for the conference and that time shall be included in the price of this Contract. The meeting shall be held at the plant.

1.7.3 Purpose of the pre-submittal conference shall be to review informally and approve the manner in which the control system Supplier intends to respond to the Contract requirements before any submittals are prepared.

1.8 GENERAL DESIGN REQUIREMENTS

1.8.1 Power Supplies

1.8.1.1 All electrically powered equipment and devices shall be suitable for operation on 115 volt ± 10 percent, 60 Hz ± 2 Hz power. If a different voltage or closer regulation is required, a suitable regulator or transformer shall be provided.

1.8.1.2 Appropriate power supplies shall be furnished by Supplier for all two wire transmitters, loops for monitoring discrete inputs and all necessary outputs. Power supplies shall be mounted in enclosures and installed in the appropriate panel.

1.8.1.3 Select all power supplies for a minimum of 130 percent of the maximum simultaneous current draw.

1.8.1.4 Provide a power on-off switch or an air circuit breaker for each item requiring electrical power.

1.8.1.5 Provide isolation transformers, line voltage regulators and power distribution panels for the digital portions of the plant monitoring and control system to eliminate electrical noise and/or transients entering on the primary power line.

1.8.2 Signal Requirements

1.8.2.1 Use 4 to 20 ma d-c analog signals, unless otherwise specified.

1.8.2.2 Provide signal converters and repeaters to maintain loop integrity even if the WFB-SCADA system is out of service.

1.8.2.3 Isolate signals from ground.

1.8.2.4 Signals shall not have a transient dc voltage exceeding 300 volts over one millisecond nor a dc component over 300 volts.

1.8.2.5 The system and associated input/output wiring will be used in a plant environment where there can be high energy ac fields, dc control pulses, and varying ground potentials between the sensors/transducers or input contact locations and the system components. The system design shall be adequate to provide proper protection against interferences from all such possible situations.

1.8.3 Miscellaneous

1.8.3.1 All WFB-SCADA system components shall be heavy duty types, designed for continuous service in a water treatment plant environment. The system is to contain products of a single manufacturer when possible and to consist of equipment models which are currently in production. All equipment provided shall be of modular construction and to be capable of field expansion through the installation of plug-in circuit cards and additional cabinets as necessary. Configure all logic and control loops to fail to a safe condition.

1.8.3.2 All WFB-SCADA System components shall return automatically to accurate measurement within 15 seconds upon restoration of power after a power failure or when transferred to standby power supply.

1.8.3.3 Provide surge protection for all control system components which could be damaged by electrical surges.

1.8.3.4 All relays with interconnections to field devices shall be wired through terminal blocks. Terminals as part of the relay base are not an acceptable alternate.

1.8.3.5 All components furnished, rear of panel devices shall be tagged with the item number and nomenclature indicated on the Contract Documents and/or approved Shop Drawings.

1.8.4 Environmental Conditions

1.8.4.1 The control system shall be designed and constructed for continuous operation under the following temperature and humidity conditions:

a. Indoor locations for digital processing equipment hardware, control panels and instruments:

- 1) Ambient Temperature: 40 F to 120 F.
- 2) Relative Humidity: 98 percent maximum.

1.8.5 Ranges and Setpoints

1.8.5.1 Range, scale and setpoint values specified are for initial setting and configuration. Modifications to these values will be required based on actual equipment furnished to implement proper and stable process action which are determined as systems are placed in operation. These modifications shall be done at no additional cost to Government.

1.8.5.2 For any items where ranges, scales and set points may not have been specified, Supplier shall submit a recommendation to Government for review.

PART 2 PRODUCTS
NOT APPLICABLE

PART 3 EXECUTION
NOT APPLICABLE

-- END OF SECTION --

SECTION 13622

INSTRUMENTATION AND CONTROL SYSTEMS
FACTORY TESTING

PART 1 GENERAL

1.1 SCOPE

1.1.1 Contractor shall provide all labor, materials, equipment and incidentals as shown, specified and required to perform factory acceptance testing before shipment, at the Contractor's facility to verify that system components are functioning properly and that they meet the functional and performance requirements of the Contract Documents.

1.1.2 The Contractor's Supplier shall submit information on factory testing procedures to verify that testing shall fulfill the requirements as specified herein. Submittal shall be made at least two months in advance of any scheduled testing and shall include proposed dates of scheduled tests.

1.1.3 Contractor shall notify Government's Contracting Officer's Representative in writing at least 14 days before expected initiation of tests. Government's Contracting Officer's Representative will be present for this test. Engineer may elect to be present at Supplier's facilities during operational test of system equipment. Presence of Government's Contracting Officer's Representative and Engineer during testing does not relieve Contractor and his Supplier from conforming to the requirements of the Contract Documents and shall in no way imply acceptance of the equipment.

1.1.4 The factory test shall demonstrate the following at a minimum:

1. Test input/output devices to verify operability and calibration.
2. Test all automatically controlled strategies, programmed by the Contractor, to verify proper operation.
3. Test all controls to verify proper operation, including power failure/reset check, diagnostic tests and memory tests.
4. Test all peripheral devices and power supplied for proper operation.
5. Test all required communications between Contractor's supplied equipment for proper transmission reception and data errors.

1.2 INSPECTION

1.2.1 All panels and cabinets shall be inspected. Inspection shall include, but not be limited to the following:

- 1.2.1.1 Nameplates and tags including all wire tags.
- 1.2.1.2 Wire sizes and color coding.
- 1.2.1.3 Terminal block contact ratings and numbers.
- 1.2.1.4 Terminal block spares.
- 1.2.1.5 Proper wiring practices and grounding.
- 1.2.1.6 Enclosure flatness, finish and color.

1.3 SYSTEM HARDWARE OPERATIONAL TESTING

1.3.1 All input/output devices and components shall be tested to verify operability and basic calibration.

1.3.2 All system hardware components equipment shall be tested to verify proper operation of the equipment as stand alone units. Test shall include, but not be limited to, the following:

1.3.2.1 AC/DC power checks.

1.3.2.2 Power fail/restart tests.

1.3.2.3 Diagnostics checks.

1.3.2.4 Test demonstrating that all specified equipment functional capabilities are working properly.

1.3.3 All system components shall be tested to verify that communication between units is working properly.

1.3.4 An integrated system test with all system equipment connected (excluding field sensors and instruments) shall be performed to verify that all equipment is performing properly as an integrated system.

1.4 SYSTEM SOFTWARE DEMONSTRATION

1.4.1 Supplier shall demonstrate all system software utility and security programs at the OITs to illustrate the various functions and capabilities specified.

1.4.2 Supplier shall demonstrate the operation and display of all software based on a simulation of all of the input/output count, both analog and discrete in an order to be selected by the manufacturer. Demonstration shall show that the monitoring and control application software associated with the input/output points performs the functions intended.

1.4.3 Supplier shall demonstrate software features illustrating the following:

1.4.3.1 Program generation.

1.4.3.2 Operating system commands.

1.4.3.3 Process Monitoring and Display: Demonstrate display and generation of each of the control system displays.

1.4.4 Upon successful completion of the Factory testing, in the opinion of the Contracting Officer's Representative, the Supplier will be authorized to ship the tested equipment. Arrangements for receiving and storing the equipment at the site shall be the responsibility of the Contractor.

PART 2 PRODUCTS

NOT APPLICABLE

PART 3 EXECUTION

NOT APPLICABLE

-- END OF SECTION --

SECTION 13623

PROCESS CONTROL SYSTEM - START-UP AND FIELD TESTING

PART 1 GENERAL

1.1 SYSTEM CHECK-OUT AND START-UP RESPONSIBILITIES

1.1.1 Contractor shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish and install all equipment and coordinate all activities necessary to perform check-out and start-up of the WFB-SCADA system.

1.1.2 Contractor shall supervise and perform check-out and start-up of all system components. As part of these services, Contractor shall include for those equipment items not manufactured by him the services of a service representative authorized by the equipment manufacturer to check the equipment installation and place the equipment in operation. The representative shall be thoroughly knowledgeable about the installation, operation and maintenance of the equipment.

1.2 SYSTEM CHECKOUT AND START-UP

1.2.1 Check and approve the installation of all control system components and all cable and wiring connections between the various system components prior to placing the various processes and equipment into operation.

1.2.2 Conduct a complete system checkout and adjustment, including calibration of all instruments, tuning of control loops, checking operation functions, and testing of final control actions. When there are future operational functions included in this work, they should be included in the system checkout. All problems encountered shall be promptly corrected to prevent any delays in start-up of the various unit processes.

1.2.3 Provide all test equipment necessary to perform the testing during system checkout and start-up.

1.2.4 Contractor shall be responsible for initial operation of West Filter Building SCADA System and shall make any required changes, adjustment or replacements for operation, monitoring and control of the various processes and equipment necessary to perform the functions intended.

1.3 INTEGRATED SYSTEM FIELD TEST

1.3.1 Following the West Filter Building SCADA System checkout and initial operation, perform a complete system test to verify that all equipment and programmed software is operating properly as a fully integrated system, and that the intended monitoring and control functions are fully implemented and operational. Correct any defects or problems found during the test shall and then retest to demonstrate proper operation.

1.3.2 Following demonstration of all system functions, West Filter Building SCADA System including field sensors/transducers and instruments shall be running and fully operational for a continuous 48 hour period. The Operational Availability Demonstration specified below shall not begin until the continuous 48 hour integrated system test has been successfully completed and Contracting Officer's Representative agrees that the Operation Availability Demonstration can begin.

1.4 OPERATIONAL AVAILABILITY DEMONSTRATION

1.4.1 Operational Availability Demonstration (OAD) shall begin following completion of the integrated system field test as specified above and shall continue until a time frame has been achieved wherein the system (both hardware and software) availability meets or exceeds 99.8 percent for 60 consecutive days and no system failures have occurred which result in starting the OAD over again. During the OAD the system shall be available to plant operating personnel for use in normal operation of the plant.

1.4.2 For the purpose of the Operational Availability Demonstration, the system will be defined as consisting of the following systems and components:

1.4.2.1 Control room operator interface equipment.

1.4.2.2 Control Panels and Cabinets.

1.4.2.3 Field instruments and devices installed or modified as part of the work.

1.4.2.4 Interfaces with starters.

1.4.2.5 Other hardware and software components.

1.4.3 The conditions listed below constitute system failures which are considered critical to the operability and maintainability of the system. The Operational Availability Demonstration shall be terminated if one or more of these conditions occur. Following correction of the problem, a new 60 consecutive day OAD shall begin. If OAD is terminated, a retest shall be performed.

1.4.3.1 Failure to repair a hardware or software problem within 120 consecutive hours from the time of notification of a system failure.

1.4.3.2 Recurrent hardware or software problems: the same type of problem occurs three times or more.

1.4.3.3 Software problem causing a processor to halt execution.

1.4.4 Each of the following conditions constitutes a system failure in determining the system availability:

1.4.4.1 Failure of Operator Interface hardware, software, or strategy.

1.4.4.2 Loss of communications between devices on the communications network.

1.4.4.3 Failure of one or more input/output components.

1.4.4.4 Failures of any type affecting ten or more input/output points simultaneously.

1.4.4.5 Failure of any type affecting one or more regulatory control loops or sequential control strategies thereby causing a loss of the automatic control of the process variable or process sequence operation.

1.4.4.6 Failure of power supply. Where redundant power supplies are provided, failure of one power supply shall not constitute a system failure provided the backup power supply operates properly and maintains supply power. Failure of the backup supply to operate properly and maintain supply power shall constitute a system failure.

1.4.4.7 Failure of three or more primary sensors/transducers or field instruments simultaneously.

1.4.4.8 Failure of redundant component to assume proper operation when primary component fails or is taken off line.

1.4.5 The system availability shall be calculated based on the following equation:

$$A = \frac{TTO}{TTO + TTR} \times 100\%$$

where, A = system availability in percent

TTO = total time in operation

TTR = total time to repair

1.4.6 Time to repair shall be the period between the time that Contractor is notified of a system failure and the time that the system has been restored to proper operation in terms of hours with an allowance for the following dead times which shall not be counted as part of the time to repair period.

1.4.6.1 Actual travel time for service personnel to get to the plant site up to 6 hours per incident from the time Contractor is notified of a system failure.

1.4.6.2 Time for receipt of spare parts to the plant site once requested up to 24 hours per incident. No work shall be done on the system while waiting for delivery of spare parts.

1.4.7 Dead time shall not be counted as part of the system test period. The dead time shall be recorded and the duration of the OAD extended for an amount of time equal to the total dead time.

1.4.8 Completion of a 60 consecutive day period without any restarts of the OAD and with a system availability in excess of that specified will constitute acceptance of the plant monitoring and control system by Contracting Officer's Representative.

1.4.9 All parts and maintenance materials required to repair the system prior to completion of the OAD shall be supplied by Contractor at no additional cost to Government. If parts are obtained from the required plant spare parts inventory, they shall be replaced to provide a full complement of parts as specified.

1.4.10 A West Filter Building SCADA System Malfunction/Repair Reporting Form shall be completed by the plant personnel and Contracting Officer's Representative to document system failures, to record Contractor notification, arrival and repair times and Contractor repair actions. Format of the form shall be developed and agreed upon prior to the start of the OAD.

1.5 SUBMITTALS

Governmental approval is required for submittals with a "GA" designation; submittals having a "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES.

SD-09, Reports

Certified Calibration Reports; FIO

Furnish to the Contracting Officer's Representative certified calibration reports for field instruments and devices and panel mounted devices as soon as calibration is completed.

Installation Inspection Report; FIO

Furnish Contracting Officer's Representative an installation inspection report certifying that all equipment has been installed correctly and is operating properly. The report shall be signed by authorized representatives of both Contractor and the equipment manufacturer.

PART 2 PRODUCTS
NOT APPLICABLE

PART 3 EXECUTION
NOT APPLICABLE

-- END OF SECTION --

SECTION 13624

INSTRUMENTATION AND CONTROL SYSTEMS TRAINING

PART 1 GENERAL

1.1 REQUIREMENTS AND RESPONSIBILITIES

1.1.1 Contractor shall provide all labor, materials, equipment and incidentals as shown, specified and required to perform and coordinate all required training at times acceptable to Contracting Officer's Representative.

1.1.2 Contractor shall retain the services of the system supplier to provide operation and maintenance training for the West Filter Building SCADA System equipment as specified herein.

1.1.3 For equipment items not manufactured by the system Supplier, he shall provide for on-site training by an authorized representative of the equipment manufacturer as part of his services. The manufacturer's representative shall be fully knowledgeable in the operation and maintenance of the equipment.

1.1.4 Contractor shall be responsible for all costs associated with training on-site and shall provide all required materials, texts.

1.1.5 All training shall be conducted in the normal eight-hour working days until conclusion of the training course.

1.2 SUBMITTALS

Governmental approval is required for submittals with a "GA" designation; submittals having a "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES.

SD-06 Instructions

Training Plan; GA|WA

Within 90 days of the effective date of the Notice to Proceed, Contractor shall submit his plan for training. Included in the plan shall be course outlines and schedules for training.

1.3 TRAINING AT THE SITE

1.3.1 General:

1.3.1.1 System and Operations training is to be provided at the site. The training is to cover the administration and operator courses identified under paragraphs B and C below.

1.3.1.2 Contractor shall provide a supplier who shall perform standardized, structured training courses.

1.3.1.3 Government will send between 8 and 14 persons to attend each training course.

1.3.2 System Training Course:

1.3.2.1 Provide a two-day course covering the development and use of system displays, the building of lines and the programming of the system. The training must also cover data archiving, report generation and other administration and support functions. The course shall include hands on training exercises based on project specific examples. The course should, at a minimum, cover the following:

- a. Overview of systems functional capabilities.
- b. Equipment overview including system component functions, operating principals and proper use.
- c. Loading and start-up of the digital system hardware components.
- d. Use of system commands.
- e. Development of programs and control schemes.
- f. Development and use of both CRT and OIT displays.
- g. Programming concepts and techniques.
- h. Instrumentation operation.

1.3.3 Operator Training Course:

1.3.3.1 Provide two separate training sessions (each 1 day, 8 hours per day, minimum) covering system navigation, graphics, faceplates, operational tools, single loop controllers and other system components and devices. The course shall familiarize the student with the procedures for applying the system to process control problems and develop student programming capability.

PART 2 PRODUCTS
NOT APPLICABLE

PART 3 EXECUTION
NOT APPLICABLE

-- END OF SECTION --

SECTION 13630

INSTRUMENTATION AND CONTROL SYSTEMS
DISTRIBUTED PROCESS CONTROLLERS

PART 1 GENERAL

1.1 SCOPE OF WORK

1.1.1 Provide distributed process controllers (DPC) with expansion racks and all necessary components and appurtenances as shown and specified herein.

1.1.2 The DPCs shall be provided in new panels and shall be configured by the system supplier to perform functions shown and specified. All DPC panels required under this Contract shall conform to the requirements as set forth in Section 13640.

1.2 QUALITY ASSURANCE

1.2.1 All materials and equipment furnished shall be new, free from defects, and of first quality, produced by manufacturers who have been regularly engaged in the manufacture of these products.

1.2.2 Where there is more than one item of similar equipment required under the Contract, all such similar equipment shall be the product of one manufacturer.

1.2.3 All material furnished under this Contract shall be determined safe by either Underwriters Laboratories, Inc., or Factory Mutual Engineering Corporation and all material shall be labeled, certified, or listed by the testing agency.

1.3 SUBMITTALS

Governmental approval is required for submittals with a "GA" designation; submittals having a "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES and Section 13621 INSTRUMENTATION AND CONTROL SYSTEMS GENERAL PROVISIONS.

SD-01 Data

Distributed Process Controllers; GA|AE

PART 2 PRODUCTS

2.1 DISTRIBUTED PROCESS CONTROLLERS

2.1.1 General:

2.1.1.1 The DPCs shall perform all the discrete control logic and interlocks for the systems specified and shown on the drawings. Specific functions to be performed by the DPC include but are not necessarily limited to the following:

- a. Alarm and status indication.
- b. PID control and arithmetic functions.

- c. Interlock and sequential logic control of processes and equipment operations.
- d. Collection and transmission of data and control parameters to and from the host processor.
- e. Provide a dry contact rated at 2 amperes and 120 volt a-c for remote indication of processor failure.

2.1.1.2 DPCs shall be capable of being programmed and updated where installed. Removal of the DPCs from where they are installed shall not be required for updating DPC control programs.

2.1.2 Required Features:

2.1.2.1 Memory:

- a. System Memory: Optional 512K bytes of Flash PROM, but a minimum of 1 MEG RAM. Lithium battery-backed RAM with minimum retention time of 4,000 hours under worst case conditions.

2.1.2.2 Processor:

- a. 32 bit Intel 386EX CMOS CPU.
- b. Clock generator
- c. Four independent, high-speed DMA channels.
- d. Programmable interrupt controller.

2.1.2.3 Provide type and quantity of I/O as listed in Section 13650, paragraph 1.2.3 for each type of I/O module used. Spare points shall be mounted and wired ready for use and shall require only field wiring connections and software configuration to place the point in service.

- a. All I/O points shall have current limiting circuitry for each I/O point.
- b. All I/O points shall have individual fusing for each I/O point.
- c. All DI and DO points shall be individually isolated.
- d. The DPC system shall provide all power for the analog inputs, analog outputs and digital inputs.
- e. All DPC I/O from the field shall come to a terminal block which is not part of any other device within the enclosure and is wired to the DPC I/O cards. All DPC I/O (including spares) shall be wired to the field termination board.

2.1.2.4 Internal Functions: Provide all necessary internal relays, timers, counters, latches, internal storage registers, and other functions with additional 20 spare capacity.

2.1.2.5 Power Supply: 120 vac, ± 10 percent with fuse or circuit breaker protection. Supplies shall be sized for a minimum of 130 percent of maximum simultaneous current draw in accordance with section 13621.

2.1.2.6 Data Communications: The filter DPCs shall communicate with the existing host DPC at DMM1 port B using BSAP asynchronous communication, sync. @ 1Mbaud. The existing network comprises the DMM1 master, DM1 slave and DM2 slave. The filter DPCs will be added to the network by extending a daisy chain sequentially from DM2 to DF28, DF30, DF32, DF34 DF36, DF27, DF29, DF31, DF33 and DF35. The cable is specified in Division 16.

2.1.2.7 OIT Communications: Provide RS-485 communications cable extending from LOP1 to DMM1, BIP1 and from LOP2 to DMM1, BIP2. The cable is specified in Division 16.

2.1.2.8 DPC Programming Software: Provide latest versions as follows including CD-ROM and full documentation:

- One copy Workbench.
- Two copies OpenBSI.
- Two copies Bristol Babcock OPC Server licenses, version 4.04 or greater.

2.1.3 DPC Manufacturer and Product: Provide the following:

2.1.3.1 DPC Hardware Complement: For each filter DPC provide:

- One 386 PM 1MB RAM CPU.
- One 2-port A/B enhanced comm. Board.
- One 8-point AI card, 4-20 mA.
- Two 16-point DI cards, 24 VDC.
- One 16-point DO card, open drain.
- One 4-point AO card, 4-20 mA.

2.1.3.2 Government Furnished Equipment: The Government will provide ten (10) Bristol 3331-10A chassis to the system supplier for installation in DF27 through DF36.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Install each item in accordance with manufacturer's recommendations and in accordance with the Contract Documents. Provide all necessary hardware accessories to complete installation.

3.1.2 The primary interface to the process equipment and field devices shall be provided by the input/output system consisting of I/O modules installed in mounting racks. Provide I/O modules as required to perform all specified functions.

3.2 START-UP, CALIBRATION, AND TESTING AND TRAINING

3.2.1 Comply with the requirements of Sections 13622, 13623, and 13624.

3.3 SPARE PARTS AND TEST EQUIPMENT

3.3.1 The Contractor shall furnish and deliver the spare parts and test equipment as outlined below, all of which shall be identical and interchangeable with similar parts furnished under this Specification.

3.3.2 The spare parts shall be packed in containers suitable for long term storage, bearing labels clearly designating the contents and the pieces of equipment for which they are intended.

3.3.3 The following shall constitute the minimum spare parts:

3.3.3.1 One of each type of input\output module.

3.3.3.2 One DPC power supply.

3.3.3.3 One CPU board.

-- END OF SECTION --

SECTION 13631

INSTRUMENTATION AND CONTROL SYSTEMS
PRIMARY SENSORS AND FIELD INSTRUMENTS

PART 1 GENERAL

1.1 DESCRIPTION

1.1.1 Scope:

1.1.1.1 Contractor shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish, install, calibrate, test, adjust and place into satisfactory operation all primary sensors and field instruments furnished under this Section, including all instrument tubing to connect new instruments to existing piping.

1.1.1.2 Drawings and Specifications illustrate and specify functional and general construction requirements of the sensors and field instruments and do not necessarily show or specify all components, wiring, piping and accessories required to make a completely integrated system. Contractor shall provide all components, piping, wiring, accessories and labor required for a complete, workable and integrated system.

1.1.1.3 Contractor shall be responsible for providing taps in the process piping systems for installation of flow, and pressure sensing instrumentation.

1.1.2 Coordination: Coordinate the installation of all items specified herein and required to ensure the complete and proper interfacing of all the components and systems.

1.1.3 Related Sections:

1.1.3.1 Section 13621, General Provisions

1.1.3.2 Section 13622, Factory Testing.

1.1.3.3 Section 13623, Startup and Field Testing.

1.1.3.4 Section 13624, Training.

1.2 QUALITY ASSURANCE

1.2.1 Comply with the requirements of Section 13621.

1.2.2 Acceptable Manufacturers:

1.2.2.1 Furnish primary sensors and field instruments by the named manufacturers or equal equipment by other manufacturers.

1.2.2.2 The named manufacturers have been specified to establish the standard of quality and performance of the equipment to be supplied.

1.2.2.3 Obtain all sensors and field instruments of a given type from the same manufacturer.

1.2.3 Manufacturers' Responsibilities and Services:

1.2.3.1 Design and manufacture the primary sensors and field instruments in accordance with the applicable general design requirements specified in Section 13621 and the detailed specifications herein.

1.2.3.2 Field supervision, inspection, start-up and training in accordance with the requirements of Sections 13623 and 13624.

1.3 PRODUCT DELIVERY, STORAGE AND HANDLING

1.3.1 Contractor shall make all arrangements for transportation, delivery and storage of the equipment and materials in accordance with the requirements of the Contract Documents, requirements of the system supplier, and requirements of equipment manufacturers.

1.3.2 Primary sensors and field instruments shall be packaged at the factory prior to shipment to protect each item from damage during shipment and storage. Containers shall be protected against impact, abrasion, corrosion, discoloration and/or other damages. Clearly label contents of each container and provide information on the required storage conditions necessary for the equipment. Keep Contracting Officer's Representative informed of equipment delivery.

1.3.3 All equipment shall be handled and stored in accordance with manufacturer's instructions and relevant organization standards. Equipment shall be protected from weather, moisture and other conditions which could cause damage. Items which require a controlled environment for storage such as panels and microprocessor units shall be stored in a climate controlled warehouse or facility. System supplier shall notify Contractor in writing with copies to Contracting Officer's Representative of the storage requirements and recommendations for the equipment prior to shipment.

1.3.4 Primary sensors and field instruments shall not be delivered to the site until all product information and system shop drawings for the sensors and instruments have been approved.

1.4 SUBMITTALS

Governmental approval is required for submittals with a "GA" designation; submittals having a "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES and Section 13621 INSTRUMENTATION AND CONTROL SYSTEMS GENERAL PROVISIONS.

SD-01 Data

Process Taps, Sensing Lines and Accessories; GA|WA
Differential Pressure Transmitters; GA|WA
Turbidity Transmitters; GA|WA
Single Loop Digital Controller; GA|WA

1.5 IDENTIFICATION TAGS

1.5.1 All sensors and field instruments shall have an identification tag meeting the following requirements:

1.5.1.1 Tag numbers for sensors and field instruments shall be as listed on the Contract Drawings and Instrument List.

1.5.1.2 The identifying tag number shall be permanently etched or embossed onto a stainless steel tag which shall be fastened to the device housing with stainless steel rivets or self tapping screws of appropriate size.

1.5.1.3 Where neither of the above fastenings can be accomplished, tags shall be permanently attached to the device by a circlet of 1/16-inch diameter stainless steel wire rope.

1.5.1.4 All sensors and field instruments mounted on or within panels shall have the stainless steel identification tag installed so that the numbers are easily visible to service personnel.

PART 2 PRODUCTS

2.1 DIFFERENTIAL PRESSURE TRANSMITTER

2.1.1 Type: Two-wire, differential capacitance or resonant type transmitter.

2.1.2 Required Features and Accessories:

2.1.2.1 Accuracy (includes combined effects of linearity, hysteresis and repeatability): ± 0.10 percent of calibrated span.

2.1.2.2 Repeatability: 0.05 percent of calibrated span.

2.1.2.3 Hysteresis: 0.05 percent of calibrated span.

2.1.2.4 Stability (drift over a 6 month period): Not more than ± 0.25 percent of transmitters upper range limit.

2.1.2.5 Ambient Temperature Effect; Total Error per 100 F change between the limits of -20 F and +180 F: Not more than ± 1.0 percent of the transmitters upper range limit (maximum span).

2.1.2.6 Supply Voltage Effect: Output change not greater than 0.005 percent of span for each one volt change in supply voltage.

2.1.2.7 Output:

- a. Isolated direct acting 4-20 madc.
- b. Digital process variable signal superimposed on 4-20 madc signal without compromising loop integrity.

2.1.2.8 Solid state electronic components.

2.1.2.9 Positive over range protection of at least 1.25 times the maximum span limit.

2.1.2.10 Calibration Adjustments:

- a. Zero: Adjustable in electronics compartment.
- b. Span: Coarse and fine span adjustments in electronics compartment.

2.1.2.11 Zero Elevation and Suppression Capability to the extent that the amount of suppression plus calibrated span does not exceed the upper range limits of the sensor.

2.1.2.12 Adjustable internal damping.

2.1.2.13 Measuring elements protected by sealing diaphragm.

- 2.1.2.14 Built-in electrical surge and RFI protection.
- 2.1.2.15 Integral square root extraction providing linear 4-20 ma dc output proportional to flow when required.
- 2.1.2.16 Electric Conduit Connection: 1/2-inch NPT.
- 2.1.2.17 Process Connections: 1/2-inch NPT.
- 2.1.2.18 Designated to operate on power from receiver or remote power supply, nominal 24 vdc.
- 2.1.2.19 Stainless steel mounting bracket and hardware suitable for mounting transmitter on flat vertical surface or 2-inch diameter pipe.
- 2.1.2.20 Process Wetted Parts: Type 316 stainless steel.
- 2.1.2.21 Non-Wetted Parts:
 - a. Body and Process Connection Bolting: Type 316 stainless steel.
 - b. Housing and Cover: Die cast low copper aluminum alloy finished with epoxy paint system; covers shall be threaded and seated on Buna-N O-rings; NEMA 4 rating.
 - c. Capsule Fill Liquid: Silicone oil.
- 2.1.2.22 Indicator: Provide integral indicator with 0 to 100 percent scale and stainless steel tag to indicate 100 percent value of range in engineering units.
- 2.1.2.23 Hand held interface with keyboard and LED display capable of easily configuring and testing the transmitter.
- 2.1.3 Product and Manufacturer: Provide one of the following:
 - 2.1.3.1 PTS Series, as manufactured by ABB/Bailey, Fisher and Porter.
 - 2.1.3.2. Or Equal.
- 2.2 TURBIDITY TRANSMITTER
 - 2.2.1 The turbidity transmitter shall be a continuous reading, on-line instrument utilizing an LED light source.
 - 2.2.1.1 Performance Requirements:
 - a. Accuracy: $\pm 2\%$ of reading or ± 0.02 NTU, whichever is greater from 0 - 40 NTU. $\pm 5\%$ of reading for 40 - 100 NTU.
 - b. Resolution: $\pm 1\%$ of reading or ± 0.002 NTU, whichever is greater.
 - c. Repeatability: ± 1.0 percent of reading.
 - d. Output: 4-20 ma current output proportional to turbidity.
 - e. Operating Temperature Range: 32 to 104 degrees F.
 - f. Two setpoint alarm system with two SPDT relays rated at 5 A.

- g. Power Supply: 120 Vac, 60 Hz

2.2.1.2 Construction Features:

- a. The turbidimeter shall consist of three main component parts: a sample unit, control unit and a power supply. The power supply and control unit shall be NEMA 4X rated
- b. The power supply shall be furnished with a minimum of 1000 volt line to line surge protection.
- c. The sample unit shall be furnished with a 1/4 inch NPT inlet and 1/2 inch NPT drain fitting.
- d. An internal bubble trap shall be provided to eliminate spikes in measurement due to transient sample conditions.
- e. The turbidimeter shall be listed to UL 3101-1 and certified to CSA 22.2, No. 1010.1.

2.2.1.3 Product and Manufacturer: Provide one of the following:

- a. Model No. 1720D, as manufactured by Hach.
- b. Or equal.

2.3 FLOW INDICATING TRANSMITTER (FIT)

2.3.1 Type: Two-wire, differential capacitance or resonant type transmitter. Transmitter shall be suitable for use with venturi flow measurement. Transmitter shall determine differential pressure across venturi and shall have suitable process connections for high and low pressure impulse lines. Transmitter shall have an integral square-root extractor to provide a 4-20mA signal proportional to flow for remote monitoring/control purposes. Local indication shall be a digital readout and shall display in gallons per minute. Local indicator shall provide the ability to scroll through the flow reading in engineering units and the inches of water reading as measured across the venturi.

2.3.2 Required Features and Accessories:

- a. Accuracy (includes combined effects of linearity, hysteresis and repeatability): .0.10 percent of calibrated span.
- b. Repeatability: 0.05 percent of calibrated span.
- c. Hysteresis: 0.05 percent of calibrated span.
- d. Stability (drift over a 6 month period): Not more than .0.25 percent of transmitters upper range limit.
- e. Ambient Temperature Effect; Total Error per 100 F change between the limits of -20 F and +180 F: Not more than .1.0 percent of the transmitters upper range limit (maximum span).
- f. Supply Voltage Effect: Output change not greater than 0.005 percent of span for each one volt change in supply voltage.
- g. Output:
 - 1) Isolated direct acting 4-20 mA-dc.
 - 2) Digital process variable signal superimposed on 4-20 mA-dc signal without compromising loop integrity.
- h. Solid state electronic components.
- i. Positive over-range protection of at least 1.25 times the maximum span limit.
- j. Calibration Adjustments:
 - 1) Zero: Adjustable in electronics compartment.
 - 2) Span: Coarse and fine span adjustments in electronics

- compartment.
- k. Zero Elevation and Suppression Capability to the extent that the amount of suppression plus calibrated span does not exceed the upper range limits of the sensor.
 - l. Adjustable internal damping.
 - m. Measuring elements protected by sealing diaphragm.
 - n. Built-in electrical surge and RFI protection.
 - o. Valves:
 - 1) Provide a single shutoff valve at each process line tap to enable live process removal of transmitter. Comply with requirements of Article 2.1.
 - 2) Provide Type 316 stainless steel three valve manifold for shutoff and pressure equalization on differential pressure and flow measurement applications.
 - p. Integral square root extraction providing linear 4-20 mA-dc output proportional to flow when required.
 - q. Electric Conduit Connection: 1/2-inch NPT.
 - r. Process Connections: 1/2-inch NPT.
 - s. Designated to operate on power from receiver or remote power supply, nominal 24 V-dc.
 - t. Stainless steel mounting bracket and hardware suitable for mounting transmitter on flat vertical surface or 2-inch diameter pipe.
 - u. Process Wetted Parts: Type 316 stainless steel.
 - v. Non-Wetted Parts:
 - 1) Body and Process Connection Bolting: Type 316 stainless steel.
 - 2) Housing and Cover: Die cast low copper aluminum alloy finished with epoxy paint system; covers shall be threaded and seated on Buna-N O-rings; NEMA 4 rating.
 - 3) Capsule Fill Liquid: Silicone oil.
 - w. Indicator: Local indication shall be a digital readout and shall display flow in gallons per minute. Local indicator shall provide the ability to scroll through the flow reading in engineering units and the inches of water reading as measured across the venturi. Engrave the instrument flow and inches of water range onto the stainless steel instrument tag supplied.
 - x. Hand held interface with keyboard and LED display capable of easily configuring and testing the transmitter.

2.3.3 Product and Manufacturer: Provide one of the following:

- a. 3051 Series, as manufactured by Rosemount, Incorporated.
- b. 821 Series, as manufactured by Foxboro Company.
- c. XTC Series, as manufactured by Moore Products Company.
- d. Or equal.

2.4 SPARE PARTS AND TEST EQUIPMENT

2.4.1 Contractor shall furnish and deliver the spare parts and test equipment as outlined below, all of which shall be identical and interchangeable with similar parts furnished under this Specification Section.

2.4.2 Spare parts shall be packed in containers suitable for long term storage, bearing labels clearly designating the contents and the pieces of equipment for which they are intended.

2.4.3 The following shall constitute the minimum spare parts:

2.4.3.1 One per ten (two, if fewer than twenty) per range of field instruments. One per five of gages, indicators and/or switches used in field complete with diaphragm seals, filled and ready for use.

- 2.4.3.2 One dozen of each type and size of fuse used in instruments.
- 2.4.4 The following shall constitute the minimum test and calibration equipment.
 - 2.4.4.1 Three Fluke, Hewlett-Packard, or equal (latest in series) digital multimeter plus amprobe, high voltage probe, test leads, case and all other recommended spares and accessories.
 - 2.4.4.2 All tooling required to insert, extract and connect any internal or external connector, including edge connectors.
 - 2.4.4.3 All special calibration equipment required for system calibration.
 - 2.4.4.4 A thermocouple calibrator including case.
 - 2.4.4.5 Two signal simulators (4-20 mA; 1-5 vd-c) including cases. One simulator shall be battery powered and shall include charger.
- 2.4.6 All spare parts shall have been operated and tested in the factory as part of factory testing prior to shipment of the control system.
- 2.4.7 For process sensors and all other analog instruments, the supplier shall submit a separate quotation for a recommended list of spare parts and test equipment. Each item recommended shall be listed and priced separately. The spare parts quotation shall contain a statement that the prices quoted are firm for a period of one year from the installation date of the equipment, and that the supplier understand that the Contracting Officer's Representative reserves the right to purchase none, any, or all of the parts quoted. The supplier is required to show that a stock of spare- parts and test-equipment is obtainable within a 48 hour period.

PART 3 EXECUTION

3.1 INSTALLATION

- 3.1.1 Contractor shall require the system supplier to furnish the services of qualified factory-trained servicemen to assist in the installation of the instrumentation and control system equipment.
- 3.1.2 Install each item in accordance with manufacturers recommendations and in accordance with the Contract Documents. Transmitters and instruments which require access for periodic calibration or maintenance shall be mounted so they are accessible while standing on the floor.
- 3.1.3 All items shall be mounted and anchored using stainless steel hardware unless otherwise noted.
- 3.1.4 All field instruments shall be rigidly secured to walls, stands or brackets as required by the manufacturer and as shown.
- 3.1.5 Conform to all applicable provisions of the NEMA standards, NEC and local, State and Federal codes when installing the equipment and interconnecting wiring.

-- END OF SECTION --

SECTION 13632

INSTRUMENT INDEX

PART 1 GENERAL

1.1 INSTRUMENT LIST

1.1.1 The Instrument List (index) for the project is included in this Section (Refer to Attached Sheets). The list is ordered by filter.

1.1.2 Specification references listed represent the specification paragraph corresponding to each instrument.

1.1.3 Surge suppression devices are not included on this list. Provide surge/lightning protection devices as specified in Section 13641.

PART 2 PRODUCTS
NOT APPLICABLE

PART 3 EXECUTION
NOT APPLICABLE

-- END OF SECTION --

INSTRUMENT INDEX

Tag	Description/Location	Range/Setpoint	Spec. Ref.	Remarks/Drawing No.
DPIT-02..F27-F35	FILTER NO. 27 DIFF. PRESSURE TRANSMITTER	0-360 IN. H2O	13631-2.2	
AIT-03..F27-F35	FILTER NO. 27 TURBIDITY TRANSMITTER	0-1 NNU	13631-2.3	
FIT-01..F27-F35	FILTER NO. 27 FLOW TRANSMITTER	0-18 IN. H2O	13631-2.2	
DPIT-06..F27-F35	FILTER NO. 29 DIFF. PRESSURE TRANSMITTER	0-360 IN. H2O	13631-2.2	
AIT-07..F27-F35	FILTER NO. 29 TURBIDITY TRANSMITTER	0-1 NNU	13631-2.3	
FIT-05..F27-F35	FILTER NO. 29 FLOW TRANSMITTER	0-18 IN. H2O	13631-2.2	
DPIT-10..F27-F35	FILTER NO. 31 DIFF. PRESSURE TRANSMITTER	0-360 IN. H2O	13631-2.2	
AIT-11..F27-F35	FILTER NO. 31 TURBIDITY TRANSMITTER	0-1 NNU	13631-2.3	
FIT-09..F27-F35	FILTER NO. 31 FLOW TRANSMITTER	0-18 IN. H2O	13631-2.2	
DPIT-14..F27-F35	FILTER NO. 33 DIFF. PRESSURE TRANSMITTER	0-360 IN. H2O	13631-2.2	
AIT-15..F27-F35	FILTER NO. 33 TURBIDITY TRANSMITTER	0-1 NNU	13631-2.3	
FIT-13..F27-F35	FILTER NO. 33 FLOW TRANSMITTER	0-18 IN. H2O	13631-2.2	
DPIT-18..F27-F35	FILTER NO. 35 DIFF. PRESSURE TRANSMITTER	0-360 IN. H2O	13631-2.2	
AIT-19..F27-F35	FILTER NO. 35 TURBIDITY TRANSMITTER	0-1 NNU	13631-2.3	
FIT-17..F27-F35	FILTER NO. 35 FLOW TRANSMITTER	0-18 IN. H2O	13631-2.2	
DPIT-02..F28-F36	FILTER NO. 28 DIFF. PRESSURE TRANSMITTER	0-360 IN. H2O	13631-2.2	
AIT-03..F28-F36	FILTER NO. 28 TURBIDITY TRANSMITTER	0-1 NNU	13631-2.3	
FIT-01..F28-F36	FILTER NO. 28 FLOW TRANSMITTER	0-18 IN. H2O	13631-2.2	
DPIT-06..F28-F36	FILTER NO. 30 DIFF. PRESSURE TRANSMITTER	0-360 IN. H2O	13631-2.2	
AIT-07..F28-F36	FILTER NO. 30 TURBIDITY TRANSMITTER	0-1 NNU	13631-2.3	
FIT-05..F28-F36	FILTER NO. 30 FLOW TRANSMITTER	0-18 IN. H2O	13631-2.2	

INSTRUMENT INDEX

Tag	Description/Location	Range/Setpoint	Spec. Ref.	Remarks/Drawing No.
DPIT-10..F28-F36	FILTER NO. 32 DIFF. PRESSURE TRANSMITTER	0-360 IN. H2O	13631-2.2	
AIT-11..F28-F36	FILTER NO. 32 TURBIDITY TRANSMITTER	0-1 NNU	13631-2.3	
FIT-09..F28-F36	FILTER NO. 32 FLOW TRANSMITTER	0-18 IN. H2O	13631-2.2	
DPIT-14..F28-F36	FILTER NO. 34 DIFF. PRESSURE TRANSMITTER	0-360 IN. H2O	13631-2.2	
AIT-15..F28-F36	FILTER NO. 34 TURBIDITY TRANSMITTER	0-1 NNU	13631-2.3	
FIT-13..F28-F36	FILTER NO. 34 FLOW TRANSMITTER	0-18 IN. H2O	13631-2.2	
DPIT-18..F28-F36	FILTER NO. 36 DIFF. PRESSURE TRANSMITTER	0-360 IN. H2O	13631-2.2	
AIT-19..F28-F36	FILTER NO. 36 TURBIDITY TRANSMITTER	0-1 NNU	13631-2.3	
FIT-17..F28-F36	FILTER NO. 36 FLOW TRANSMITTER	0-18 IN. H2O	13631-2.2	
FLMT-1..F27	MASTER BACKWASH FLOW TRANSMITTER	0-16 IN. H2O	13631-2.2	
FLMC-1..F27	MASTER BACKWASH FLOW CONTROLLER	0-1000 GPM	13631-2.3	

SECTION 13640

CONTROL PANELS AND ENCLOSURES

PART 1 GENERAL

1.1 DESCRIPTION

1.1.1 Scope: Contractor shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish, install, calibrate, test, start-up and place into satisfactory operation all control panels and/or enclosures shown on the instrumentation drawings and identified in the Specifications.

1.1.2 Related Sections:

1.1.2.1 Division 16, Electrical.

1.1.2.2 Section 13641, Panel Instruments and Devices.

1.2 QUALITY CONTROL

1.2.1 Standards, Codes and Regulations:

1.2.1.1 Construction of panels and the installation and interconnection of all equipment and devices mounted within shall comply with applicable provisions of the following standards, codes and regulations:

- a. Joint Industrial Council (JIC) Standards.
- b. National Electrical Code (NEC).
- c. National Electrical Manufacturer's Association Standards (NEMA).
- d. American Society for Testing and Materials (ASTM).
- e. Operational Safety and Health Administration (OSHA) Regulations.
- f. State and Local code requirements.
- g. Where any conflict arises between codes or standards, the more stringent requirement shall apply.

1.2.1.2 All materials and equipment shall be new and all panels shall be built in an Underwriters Laboratory (UL), Inc. approved panel shop and bear the UL label.

1.2.2 General Design Requirements:

1.2.2.1 Comply with the requirements of Section 13621.

1.2.2.2 Comply with the control descriptions of Section 13660.

1.2.3 Factory Assembly and Testing:

1.2.3.1 Comply with the requirements of Section 13622.

1.3 SUBMITTALS

Governmental approval is required for submittals with a "GA" designation; submittals having a "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES and Section 13621 INSTRUMENTATION AND CONTROL SYSTEMS GENERAL PROVISIONS.

SD-01 Data

Panels and Enclosures; GA|WA

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

1.4.1 Comply with the requirements of Section 13621.

PART 2 PRODUCTS

2.1 GENERAL CONSTRUCTION REQUIREMENTS

2.1.1 Provide all electrical and/or pneumatic components and devices, support hardware, fasteners, interconnecting wiring and/or piping required to make the control panels and/or enclosures complete and operational.

2.1.2 Locate and install all devices and components so that connections can be easily made and that there is ample room for servicing each item.

2.1.3 Components for installation on panel exterior shall be located generally as shown. Layouts shall be submitted for approval.

2.1.4 Where permitted by location and layout as shown, panels and enclosures shall have full height rear access doors. Where rear doors are not possible, panels shall have full or half height front access doors.

2.1.5 Adequately support and restrain all devices and components mounted on or within the panel to prevent any movement.

2.1.6 Provide sub-panels for installation of all relays and other internally mounted components.

2.1.7 All wiring to panel connections from field instruments, devices, and other panels shall be terminated at master numbered terminal strips, unless otherwise specified.

2.1.8 Provide copper grounding studs for all panel equipment.

2.1.9 Provide the following convenience accessories inside of each control panel:

2.1.9.1 One 120 v a-c, 20 A duplex, grounding type receptacle.

2.1.9.2 One 120 v a-c fluorescent light fixture with 40 watt lamp and protective plastic shield.

2.1.9.3 One 120 v a-c, 20 A, snap switch, to turn on the light, mounted in an outlet box with a cover and located so that it is easily accessible from access door.

2.1.9.4 Service light with switch and duplex receptacle shall have its own circuit breaker.

2.1.10 The bottom 12 inches of free standing panels shall be free of all devices, including terminal strips, to provide ease of installation and testing.

2.2 IDENTIFICATION

2.2.1 Provide laminated plastic nameplates for identification of panels and components mounted thereon as follows:

2.2.1.1 Nameplates shall be of 3/32-inch thick laminated phenolic type with white matte finish surface and black letter engraving.

2.2.1.2 Panel identification nameplates to have 1/2-inch high letter engravings.

2.2.1.3 Panel mounted component (i.e., control devices, indicating lights, selector switches, etc.) identification nameplates to have 1/4-inch high letter engravings.

2.2.1.4 Nameplates shall be attached to the panel face with two stainless steel self-tapping screws.

2.2.1.5 Nameplate engravings shall include the instrument or equipment tag number and descriptive title as shown and specified.

2.2.2 Tag all internally mounted instruments in accordance with the following requirements:

2.2.2.1 Tag numbers shall be as listed in the Instrument Index.

2.2.2.2 The identifying tag number shall be permanently etched or embossed onto a stainless steel tag which shall be fastened to the device housing with stainless steel rivets or self tapping screws of appropriate size.

2.2.2.3 Where neither of the above fastenings can be accomplished, tags shall be permanently attached to the device by a circlet of 1/16-inch diameter stainless steel wire rope.

2.2.2.4 Identification tag shall be installed so that the numbers are easily visible to service personnel.

2.2.2.5 Front of panel mounted instruments shall have the tag attached to rear of device.

2.2.3 Tagging of the following items shall be accomplished with the use of adhesive plastic Brady USA, Inc. labels, or equal.

2.2.3.1 Tag all electrical devices (i.e., relays, timers, power supplies) mounted within control panels and enclosures.

2.2.3.2 Tag all pneumatic lines.

2.2.3.3 Numerically tag all terminal blocks.

2.2.3.4 Color code and numerically tag wiring at each end.

2.3 PANELS AND ENCLOSURES

2.3.1 General:

2.3.1.1 All Panels and enclosures shall meet NEMA 4X requirements.

2.3.1.2 Sizes shown are estimates. Contractor shall furnish panels and enclosures amply sized to house all equipment, instruments, front panel mounted devices, power supplies, power distribution panels, wiring, tubing and other components installed within.

2.3.1.3 The Contractor shall provide 10 percent additional space at each panel for future devices.

2.3.2 Construction Features:

2.3.2.1 All control panels and cabinets shall be NEMA 4X rated and shall conform to the following:

- a. Panels shall be of molded fiberglass construction. A resin color shall be added to the FRP resin to match that of the existing enclosures.
- b. Rolled lip around three sides of door and along top of enclosure opening.
- d. Hasp and staple for padlocking.
- e. Provide a clear plastic, gasketed lockable hinged door to encompass all non-NEMA 4 front of panel instruments.
- f. Provide 3-inch high channel base assembly, with solid bottom, drilled to mate the panel to its floor pad.
- g. Enclosure Sealing: For all panels listed in Section 1.1.2.2 of this Specification Section, provide "duckseal", or equal, for sealing all conduit entry enclosure openings.

2.3.3 Electrical Systems:

2.3.3.1 Control of Environment:

- a. Provide adequately sized, automatically controlled 120 va-c strip heaters to maintain temperature 10 F above ambient for condensation prevention inside panels.
- b. Provide an environmental purge control unit. The unit shall prevent fugitive gasses such as chlorine from entering the panel and will reduce concentrations over time.
- c. Instrument purge air system shall include air regulator and pressure gauge ranged from 0 - 1 inches of water. Clean air supply shall maintain slight positive internal pressure. On loss of panel pressure, system shall be responsible to repressurize the panel. Purging system automatic control action shall be user-defined, with bypass and lockout capabilities. A redundant regulator set to 5 PSI maximum shall be provided.
- d. Plant air shall be provided with pressure of 50-100 psi. Supply connection to purge control unit shall be 1/2" NPT.
- e. Purge system shall be mounted in accordance with contract drawings and manufacturer's recommendations. Contractor shall provide top or side-mounted purge unit depending on field verification of space availability and manufacturer's recommendations.

f. Product and Manufacturer:

- 1) Model 1001 Series by Beeco Industries.
- 2) Or equal.

2.3.3.2 Power Source and Internal Power Distribution:

- a. General: Control panel power supply source, type, voltage, number of circuits and circuit ratings shall be as shown.
- b. Panels shall be provided with an internal 120 va-c power distribution panel with number of circuits and separate circuit breakers sized as required to distribute power to the panel components. Distribution panel shall contain two spare breakers minimum.

2.3.3.3 Wiring:

- a. Internal wiring shall be Type THHN stranded copper wire with thermoplastic insulation rated for 600 V at 85 C for single conductors, color coded and labeled with wire identification.
- b. For d-c panel signal wiring, use No. 18 minimum AWG shielded.
- c. For a-c power wiring, use No. 12 minimum AWG. For a-c signal and control wiring, use No. 16 minimum AWG. For wiring carrying more than 15 amps, use sizes required by NEC and JIC standards.
- d. Separate and shield low voltage signal wiring from power and control wiring by a minimum of 6 inches.
- e. Group or bundle parallel runs of wire using covered troughs. Maximum bundle size to be 1 inch. Troughs shall have 40 percent spare capacity.
- f. Install wire troughs along horizontal or vertical routes to present a neat appearance. Angled runs are not acceptable.
- g. Adequately support and restrain all wiring runs to prevent sagging or other movement.
- h. Terminate all field wiring using forked, insulated, crimp-on connectors (soldered type not acceptable) at 600 V rated barrier type terminal strips with screwed connections and permanently affixed numeric identifiers beside each connection. Identifiers to be self-stick plastic tape strips with permanent type, machine printed numbers. For d-c field signal wiring, terminal strips shall be capable of handling No. 12 wiring (minimum). Provide Phoenix Contact, Entrelec or Allen Bradley.
- i. All wiring shall be installed such that if wires are removed from any one device, power will not be disrupted to any other device.
- j. All alarms generated external to the panel, spare alarm, and repeat contacts shall be wired out to terminal blocks.
- k. For internal component to component wiring only, compression type terminal blocks are acceptable.

- l. Provide spare terminals equal in number to 20 percent of the terminals used for each type of wiring (i.e., d-c signal and a-c power).
- m. Provide a separate terminal for grounding each shielded cable.
- n. Use separate 5/16-inch diameter copper grounding studs for instrument signal cable shields and a-c power.
- o. Where wires pass through panel walls, provide suitable bushings to prevent cutting or abrading of insulation.
- p. When d-c power and/or low voltage a-c power is required, provide and install the necessary power supplies and transformers in the panel.
- q. Provide circuit breakers to protect each circuit, with no more than six instruments on a single circuit.
- r. Provide complete wiring diagram showing "as built" circuitry. Diagram shall be enclosed in transparent plastic and placed in easily accessible pocket built into panel door.

2.3.3.4 Surge Protection:

- a. General: Surge protection shall be provided to protect the electronic instrumentation system from surges propagating along the signal and power supply lines. The protection systems shall be such that the protection level shall not interfere with normal operation, but shall be lower than the instrument surge withstand level, and be maintenance free and self-restoring. Instruments shall be housed in suitable metallic cases, properly grounded. Ground wires for all surge protectors shall be connected to a good earth ground and where practical each ground wire run individually and insulated from each other. These protectors shall be mounted within the instrument enclosure or a separate junction box (compatible with the area designation) coupled to the enclosure.
- b. Provide formal lightning and surge protection devices for signal lines, data highways (other than fiber optic lines), and power feeds to hardware, that originate or are routed outside a building on any part of the circuit, in either buried or exposed raceways. Provide formal lightning and surge protection for all transmitters installed under this Contract in an outside environment.
- c. Lightning and surge protection devices shall be standard manufactured products comprising multi-component networks or hybrid circuits. The units shall incorporate gas filled discharge tubes, and zener diodes providing full protection from line to line and from line to ground. Units shall be din-rail mounted, rated for a 10KA maximum surge current and voltage suitable for the type of circuit being protected. Reaction time shall be in the order of nanoseconds.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Install equipment in conformance with NEC.

3.1.2 Unless otherwise noted, install panels on 4-inch concrete pad. Extend pad 4 inches beyond outside dimensions of base, all sides. Lay grout after panel sills have been securely fastened down.

3.1.3 Install anchor bolts and anchor in accordance with Section 05051.

3.1.4 Install and interconnect all equipment, devices, electrical hardware, instrumentation and controls and process controller components into and out of and among the enclosures as indicated on the Drawings.

3.1.5 Connect all new panels to existing ground grid. Assume an average distance of forty feet for connection to ground grid at each panel.

3.2 TESTING AND ADJUSTMENTS

3.2.1 Perform system testing and make any adjustments necessary in accordance with this Section and Sections 13621, 13622, and 13623.

3.2.2 Perform power supply, voltage adjustments to tolerances required by the appurtenant equipment.

-- END OF SECTION --

SECTION 13641

INSTRUMENTATION AND CONTROL SYSTEMS
PANEL INSTRUMENTS AND DEVICES

PART 1 GENERAL

1.1 DESCRIPTION

1.1.1 Scope:

1.1.1.1 Contractor shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish, install, calibrate, test, adjust and place into satisfactory operation panel instruments and devices.

1.1.1.2 Drawings and Specifications illustrate and specify functional and general construction requirements of the panel components and do not necessarily show or specify all components, wiring, piping and accessories required to make a completely integrated system. Contractor shall provide all piping, wiring, accessories and labor required for a complete, workable and integrated system.

1.1.2 Coordination: Coordinate the installation of all items specified herein and required to ensure the complete and proper interfacing of all the components and systems.

1.2 QUALITY ASSURANCE

1.2.1 Comply with the requirements of Section 13621.

1.2.2 Acceptable Manufacturers:

1.2.2.1 Furnish instruments and devices by the named manufacturers or equal equipment by other manufacturers.

1.2.2.2 The named manufacturers have been specified to establish the standard of quality and performance of the equipment to be supplied.

1.2.2.3 Obtain all instruments or devices of a given type from the same manufacturer.

1.2 PRODUCT DELIVERY, STORAGE AND HANDLING

1.2.1 Comply with the requirements specified in Section 13621.

1.2.2 Instruments and devices shall not be assembled in the panels until all product information and system shop drawings for respective components have been approved.

1.3 IDENTIFICATION TAGS

1.3.1 All panel instruments and devices shall have an identification tag meeting the following requirements:

1.3.1.1 Tag numbers shall be as listed in the Instrument Index.

1.3.1.2 Identifying tag number shall be permanently etched or embossed onto a stainless steel tag which shall be fastened to the device housing with stainless steel rivets or self tapping screws of appropriate size.

1.3.1.3 Where neither of the above fastenings can be accomplished, tags shall be permanently attached to the device by a circlet of 1/16-inch diameter stainless steel wire rope.

1.3.1.4 All instruments and devices mounted within panels shall have the stainless steel identification tag installed so that the numbers are easily visible to service personnel. Front of panel mounted components shall have the tag attached to the rear of the device.

1.4 SUBMITTALS

Governmental approval is required for submittals with a "GA" designation; submittals having a "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES and Section 13621 INSTRUMENTATION AND CONTROL SYSTEMS GENERAL PROVISIONS.

SD-01 Data

Power Supplies; GA|WA
Signal Isolator; GA|WA
Control Relay; GA|WA
Time Delay Relay; GA|WA
Selector Switch, Pushbuttons and Indicator Lights; GA|WA
Operator Interface Terminal Hardware; GA|WA

PART 2 PRODUCTS

2.1 POWER SUPPLIES

2.1.1 General: Single unit and multiple unit power supplies, located in control room panels, digital processor controller units and field panels as required.

2.1.2 Multiple Unit Required Features:

2.1.2.1 Solid state circuitry.

2.1.2.2 Surface mounting.

2.1.2.3 Input Voltage: 117 va-c ± 10 percent, 60 Hz.

2.1.2.4 Output Power: 24 vd-c or as required.

2.1.2.5 Line/Load Regulation: ± 0.005 percent.

2.1.2.6 Ripple: 0.25 mV RMS.

2.1.2.7 Include an internal preset over voltage protector.

2.1.2.8 Include mounting brackets, fuse and mating connector for AC power plug.

2.1.3 Product Manufacturer: Provide power supply units of one of the following:

2.1.3.1 Acopian Corporation.

2.1.3.2 Or equal.

2.2 SIGNAL ISOLATOR

2.2.1 General: The isolating unit shall be an externally powered (120V) device. It shall accept an input signal (4-20 ma, 1-5 v d-c, pulse duration) and deliver an isolated 4-20 ma output.

2.2.2 Required Features:

2.2.2.1 Repeatability: ± 1 percent of span.

2.2.2.2 Ambient Temperature Range: -25 F to +185 F.

2.2.2.3 Linearity: ± 0.1 percent of full scale.

2.2.2.4 Provide one spare isolator.

2.2.3 Product Manufacturer: Provide current isolator of one of the following:

2.2.3.1 AGM.

2.2.3.2 Rochester Instrument System.

2.2.3.3 Ronan.

2.2.3.4 Or equal.

2.3 CONTROL RELAY

2.3.1 Type: General purpose, plug-in type rated for continuous duty.

2.3.2 Construction Features:

2.3.2.1 Coil Voltages: 24 vd-c and 120 va-c as required.

2.3.2.2 Contacts:

a. Silver cadmium oxide rated not less than 5 amperes resistive at 120 va-c or 28 vd-c continuous.

b. For switching low energy circuits (less than 200 ma) fine silver, gold flashed contacts rated not less than 3 amperes resistive at 120 va-c or 28 vd-c continuous shall be provided.

2.3.2.3 Relays to have clear plastic dust cover.

2.3.2.4 Relays to be UL recognized.

2.3.3 Product and Manufacturer: Provide one of the following:

2.3.3.1 Type R and/or Type K, as manufactured by Square D Company.

2.3.3.2 Or equal.

2.4 TIME DELAY RELAY

2.4.1 Type: Dial adjustable, plug-in type time delay relay providing delay-on-make, delay-on-break or interval operation.

2.4.2 Construction Features:

2.4.2.1 MOS digital circuit with transformer coupled power.

2.4.2.2 Switch selectable ranges as follows:

- a. 1 second.
- b. 10 seconds.
- c. 1 minute.
- d. 10 minutes.
- e. 1 hour.
- f. 10 hours.

2.4.2.3 Minimum Setting: 3 percent of range, except 50 ms for 1 second range.

2.4.2.4 Contacts:

- a. Type: DPDT.
- b. Rating: 7 amps resistive at 120 va-c, 7 amps at 24 vd-c.

2.4.2.5 Housing: Plug-in design with dust and moisture resistant molded plastic case.

2.4.2.6 Power Input: 120 va-c and 24 vd-c as required.

2.4.2.7 Relays to be UL recognized.

2.4.3 Product and Manufacturer: Provide one of the following:

2.4.3.1 Series 328, as manufactured by Automatic Timing and Controls Company.

2.4.3.2 Or equal.

2.5 SELECTOR SWITCHES, PUSHBUTTONS AND INDICATING LIGHTS

2.5.1 General:

2.5.1.1 Selector switches, pushbuttons and indicating lights shall be supplied by one manufacturer and be of the same series or model type.

2.5.1.2 Type:

- a. Heavy duty, oil tight.

2.5.1.3 Provide legend plate for indication of switch, pushbutton or light function (i.e. Open-Closed, Hand-Off-Auto).

2.5.1.4 Mounting: Flush mounted on control panel front, unless otherwise noted.

2.5.1.5 NEMA rated to match panel in which mounted.

2.5.2 Selector Switches:

2.5.2.1 Type: Provide selector switches with number of positions as required to perform intended functions as shown and specified.

2.5.2.2 Contacts:

- a. Provide number and arrangement of contacts as required to perform intended functions specified but not less than one single pole, double throw contact.
- b. Type: Double break, silver contacts with movable contact blade providing scrubbing action.
- c. Rating: Compatible with a-c or d-c current with devices simultaneously operated by the switch contacts but not less than 10 amperes resistive at 120 volts a-c or d-c continuous.

2.5.2.3 Switch Operator: Standard black knob.

2.5.3 Pushbuttons (Standard or Illuminated):

2.5.3.1 Type: Provide momentary lighted and/or unlighted, single and/or dual type pushbuttons as required to perform intended functions specified and shown.

2.5.3.2 Contacts: Comply with the requirements specified for selector switches.

2.5.4 Indicating Lights:

2.5.4.1 Type: Compact, integral transformer type.

2.5.4.2 Lamps: 6 volt, long life (20,000 hours minimum).

2.5.4.3 Common, push to test circuitry shall be provided for each panel to simultaneously test all indicating lights on the panel using a single pushbutton.

2.5.5 Rotary Cam Switches:

2.5.5.1 Provide rotary cam switches with number of positions and poles as required to perform the required signal switching function specified and shown.

2.5.5.2 Contacts:

- a. Gold-flashed contacts housed in mechanical contact blocks with number and arrangement of contacts as required to perform intended functions.
- b. Contact Rating: Compatible with a-c or d-c through-put current of signals and devices simultaneously operated by the switch contacts but not less than 20 amperes at 600 va-c or 250 vd-c continuous.

2.5.5.3 Switch Operator: Standard black knob.

2.5.6 Product and Manufacturer: Provide one of the following:

2.5.6.1 Type E30, as manufactured by Cutler-Hammer.

2.5.6.2 Series 800, as manufactured by Allen Bradley.

2.5.6.3 Or equal.

2.6 OPERATOR INTERFACE TERMINAL (OIT) HARDWARE

2.6.1 The Operator Interface Terminal shall be a 17-inch LCD color monitor and shall be installed in each filter Local Operator Panel. The OIT shall be mounted in the LOP beneath a viewing window. Each station shall be constructed of identical parts and components and shall be provided with the following features and functions, minimum:

2.6.1.1 Monitor, 17-inch LCD color display, standard keyboard with mouse.

2.6.1.2 IBM PC/AT™-compatible with 1GHz processor minimum.

2.6.1.3 PCI VGA video controller with a minimum 2MB Video RAM on board or AGP, supporting up to 1024 x 768 resolution.

2.6.1.4 Six-slot backplane, with a minimum of two PCI slots, minimum

2.6.1.5 256 MB minimum SDRAM, expandable to 512 MB..

2.6.1.6 3.5-inch side-access 1.44 MB floppy diskette drive.

2.6.1.7 20 GB, minimum Hard Disk Drive.

2.6.1.8 Minimum 250 Watt Power Supply operating form 90-135 VAC at 47 to 63 Hz.

2.6.1.9 24X CD-ROM Drive, minimum.

2.6.1.10 Two 80 cfm cooling fans.

2.6.1.11 Two serial ports, one bidirectional parallel port, two USB ports.

2.6.1.12 Operating Vibration Rating of 5 to 15 Hz, 0.25 Gs peak-to-peak; 15 to 500 Hz, 2.5 Gs peak-to-peak.

2.6.1.13 Operating Temperature rating of 0 to 45 C.

2.6.1.14 Storage Temperature rating of -20 to 60 C.

2.6.1.15 Relative Humidity rating of 5 to 95%, non-condensing.

2.6.1.16 Altitude Operating rating to 10,000 feet.

2.6.1.17 OIT Manufacturer and Product: Provide the following:

a. Dell Products.

b. Or equal.

2.6.2 Each OIT shall be provided with Windows 2000 Operating System and the latest version of Graph Wor X32 graphical interface software installed. Provide CD-ROMs, licenses and full documentation for each as deliverable items.

2.7 SINGLE LOOP DIGITAL CONTROLLER (SLDC)

2.7.1 General: Separate, Single Station Electronic Indicating (Single Loop) Controllers shall be provided for executing stand-alone, automatic regulatory loop control as shown. The controllers shall match in appearance other panel mounted instruments.

2.7.2 Type: Microprocessor-based controller with single loop integrity and user configuration capability.

2.7.3 Required Design and Construction Features:

2.7.3.1 Modular Construction.

2.7.3.2 Front panel LED, gas-discharge or vacuum-fluorescent type, user configurable displays as follows:

- a. Two vertical bar graphs with percentage scales; capability to provide direct reading scales, insertable without tools, shall be available.
- b. Digital readout display, 4 digits (minimum) with decimal point and minus sign typically for display of the Engineering unit values associated with the two vertical bar graphs.
- c. One horizontal bar graph with 0 to 100 percent scale or an auxiliary 4 digit (minimum) digital indicator display, typically for output value.

2.7.3.3 Front panel pushbuttons or membrane type keypad controls for the following:

- a. Digital display selector.
- b. Remote-Ratio/Local setpoint mode selector.
- c. Automatic/Manual output control selector permitting bumpless, balanceless transfer.
- d. Raise/Lower setpoint adjustments.
- e. Increase/Decrease manual output adjustments.

2.7.3.4 Discrete Status Indicators for the following:

- a. Indication of values displayed on the digital readout display.
- b. Indication of remote or local setpoint mode.
- c. Indication of automatic or manual mode of operation.
- d. Process alarm limit indication of two separate alarm limit settings.

2.7.3.5 Mounting Requirements: Designed for flush panel mounting; suitable for single and multiple case mounting.

2.7.3.6 Power Requirements: Unit shall be designed to operate on nominal 24 vd-c power provided by an external panel/instrument power supply. Lithium battery backup shall be provided for controller memory.

2.7.3.7 Input/Output Capabilities:

- a. Analog Inputs:
 - 1) Type: 4-20 ma-d-c current signals and 1-5 v-d-c signals.
 - 2) Quantity: Three, minimum.
 - 3) Resolution: 12 bit binary (± 0.025 percent).
 - 4) Accessories: Provide auxiliary signal isolators where output controls more than one device.
- b. Analog Outputs:
 - 1) Type: 4-20 ma-d-c.
 - 2) Quantity: Two separate outputs, minimum.
 - 3) Accessories: Provide auxiliary signal isolators when output controls more than one device.
- c. Digital Inputs:
 - 1) Type: 0-15 v-d-c logic level.
 - 2) Quantity: Two minimum.
 - 3) Accessories: Provide auxiliary interposing relays when required to interface higher level control/ status/ alarm input signals.
- d. Digital Outputs:
 - 1) Type: Solid state, open-collector transistor type, logic level outputs (30 v-d-c maximum).
 - 2) Quantity: Two minimum.
 - 3) Accessories: Provide auxiliary interposing relays when required to provide higher level control/status/alarm outputs.

2.7.3.8 Microprocessor Sampling and Update Rates:

- a. PID and Control Program Execution Rate: Program executed once per 0.1 seconds.
- b. Input Signal Sampling Rate: 0.1 seconds.
- c. Display Update: 0.1 seconds.
- d. Output Signal Update: 0.1 seconds.

2.7.3.9 Required Operational and Functional Capabilities:

- a. Processing capability for a minimum of one PID control loop with analog input signal conditioning, and remote setpoint and ratio control functions.
- b. Anti-reset windup.

- c. Ramp setpoint capability.
- d. Output limiting.
- e. Alarming (absolute process and deviation).
- f. Calculation Functions:
 - 1) Addition.
 - 2) Subtraction.
 - 3) Multiplication.
 - 4) Division.
 - 5) Square Root.
- g. Ratio Control.
- h. Lead/Lag.
- i. Override control via remote inputs and/or internal program logic.
- j. Totalization capability.
- k. Digital logic operations.
- l. On-Off digital output control.
- m. Configurable power fail-auto restart in previous mode at last output or in manual at a preset output.
- n. Balanceless and bumpless control transfer between all operating modes.
- o. Internal operating diagnostics to detect hardware malfunctions, memory error, loss of input and low memory battery backup voltage.

2.7.3.10 Communication Capability: Unit shall be designed to permit bi-directional communication with other controllers and a supervisory control system and/or host computer utilizing an RS-485 Serial Communication link.

2.7.3.11 Configuration Capability and Accessories:

- a. Controller shall be user-configurable by means of a portable, hand-held configuration terminal or from the controller front keypad upon entry of a security code password. The hand-held terminal shall plug directly into the front panel of the controller.
- b. Controllers shall be completely pre-configured by the instrumentation and control system supplier to perform the control algorithms and functions shown and/or specified.
- c. Controller configuration shall be capable of being copied and transported by either of the following methods:
 - 1) Portable, battery-backed RAM memory module or NOVRAM module with copy accessory installed in controller and capable of

both copying and loading the controller configuration data base.

- 2) External, portable programming terminal with tape cassette or disc drive for off-line programming, editing, and copying of configurations and block downloading of configurations to the connected controller.

- d. One portable, hand-held configuration terminal shall be supplied with the controllers.

2.7.3.12 PID Control Range Adjustment:

- a. Proportional Band: 0 (off) to 1000 percent.
- b. Integral: 0.04 seconds to 100 minutes and off.
- c. Derivative: 0.01 minutes to 100 minutes and off.
- d. Manual Reset: 0 to 100 percent.

2.7.3.13 Connections: Provide compression type terminals for power and signal line connections.

2.7.3.14 Product and Manufacturer: Provide one of the following:

- a. Model 53MC, as manufactured by Bailey/Fischer and Porter.
- b. Or equal.

2.8 CYCLE TIMER

2.8.1 GENERAL

2.8.1.1 Type:1 Adjustable, microprocessor-based instantaneous SPDT multipurpose timer/counter. Timer starts when power is applied and the instantaneous relay is energized. When preset value is reached the Delayed SPDT is energized. Timer remains in timed-out condition until reset by removing power.

2.8.1.2 Type:2 Adjustable, microprocessor-based instantaneous DPDT multipurpose timer/counter. Timer starts when power is applied and the instantaneous relay is energized. When preset value is reached the Delayed DPDT is energized. Timer remains in timed-out condition until reset by removing power.

2.8.1.3 Type: 3 True Off-Delay Relay - Knob adjustable plug-in relay DPDT 10 amp. When voltage is applied to input terminals relay energizes. When voltage is removed, the OFF delay begins. Upon completion of delay period, the relay de-energizes. Reset is accomplished by reapplying voltage to the input terminals. If voltage is reapplied during the delay period the relay remains picked up and timer resets to zero.

2.8.2 CONSTRUCTION FEATURES

2.8.2.1 Switch selectable ranges as follows:

- a. 0.1 sec-999 hours for type 1 & 2 relays.
- b. 0.1 sec to 5 sec for type 3 relay.

2.8.2.2 Repeat Accuracy:

- a. 1% over range for type 1 & 2 relays.
- b. 1% over range for type 3 relay.

2.8.2.3 Operating Temperature: 32 to 140°F.

2.8.2.4 Cycle Progress Display: 3 digit LED display, programmable to run up to or down from the setpoint and to stop or continue up from zero after time-out/count-out.

2.8.2.5 Load Relays:

- a. Type: DPDT.
- b. Number: One early and one delayed.
- c. Contact Ratings: 5 amperes @ 250VAC.

2.8.2.6 Terminals: Screw terminals accessible at rear.

2.8.2.7 Housing: Fully gasketed, dust and watertight.

2.8.2.8 Power Input: 120 va-c and 234 va-c required.

2.8.3 Product and Manufacturer:

2.8.3.1 Series 425A as manufactured by Automatic Timing and Controls Company for type 1 & 2 relays.

2.8.3.2 Series 663 as manufactured by Automatic Timing and Controls Company for type 3 relay.

2.8.3.3 Or equal.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Install each item in accordance with manufacturers recommendations and in accordance with the Contract Documents.

3.1.2 All items shall be mounted and anchored in compliance with Section 13640.

3.2 START-UP, CALIBRATION, AND TESTING AND TRAINING

3.2.1 Comply with the requirements of Section 13621.

-- END OF SECTION --

SECTION 13650

INSTRUMENTATION AND CONTROL SYSTEMS
INPUT/OUTPUT POINT LIST

PART 1 GENERAL

1.1 GENERAL

1.1.1 The Contractor shall provide all labor, materials, equipment and incidentals to configure inputs and outputs for the West Filter Building SCADA system as shown and as specified.

1.2 INPUT/OUTPUT POINT LIST

1.2.1 The Input/Output Point (I/O) list for the project is included in this Section (Refer to Attached Sheets). 'System' signals such as 'purge' and 'master' are distributed among DF 27 through DF36.

1.2.2 The I/O list does not identify the requirements for spare inputs and outputs. For each Input/Output location identified provide a minimum of 20 percent spare inputs and outputs of each type. Spares shall be wired from the cards to the field terminals allowing for future use.

1.2.3 Summary of I/O counts:

DF 27-35 (odd filters)	AI	AO	DI	DO
Filter Points	20	5	100	65
Master Points	2	1	3	0
Misc.	0	0	7	0
SUBTOTAL	22	6	110	65
Cards	5	5	10 (8)	5 (8)
Spare Points	18	14	50	15
DF 28-36 (even filters)	AI	AO	DI	DO
Filter Points	20	5	100	65
Master Points	2	1	3	0
Misc.	0	0	0	0
SUBTOTAL	22	6	103	65
Cards	5	5	10	5
Spare Points	18	14	50	15
TOTAL POINTS	44	12	213	130
TOTAL CARDS	10	10	20	10

1.3 RELATED SECTIONS

1.3.1 All Division 16 Sections

1.3.2 All applicable Division 13 Sections

PART 2 PRODUCTS
NOT APPLICABLE

PART 3 EXECUTION
NOT APPLICABLE

-- END OF SECTION --

INPUT/OUTPUT LIST

Tag	Description/Location	Type	Input from/Output to	Remarks/Drawing No.
F-AI002..F27-F35	FILTER NO. 27 FILTER HEAD LOSS	AI		
Z-DI001..F27-F35	FILTER NO. 27 INFLUENT VALVE OPENED	DI		
Z-DI002..F27-F35	FILTER NO. 27 INFLUENT VALVE CLOSED	DI		
N-DO001..F27-F35	FILTER NO. 27 INFLUENT VALVE OPEN	DO		
N-DO002..F27-F35	FILTER NO. 27 INFLUENT VALVE CLOSE	DO		
Z-DI003..F27-F35	FILTER NO. 27 EFFLUENT VALVE NO. 1 OPENED	DI		
Z-DI004..F27-F35	FILTER NO. 27 EFFLUENT VALVE NO.1 CLOSED	DI		
N-DO003..F27-F35	FILTER NO. 27 EFFLUENT VALVE NO. 1 OPEN	DO		
N-DO004..F27-F35	FILTER NO. 27 EFFLUENT VALVE NO. 1 CLOSE	DO		
Z-DI005..F27-F35	FILTER NO. 27 EFFLUENT VALVE NO. 2 OPENED	DI		
Z-DI006..F27-F35	FILTER NO. 27 EFFLUENT VALVE NO.2 CLOSED	DI		
N-DO005..F27-F35	FILTER NO. 27 EFFLUENT VALVE NO. 2 OPEN	DO		
N-DO006..F27-F35	FILTER NO. 27 EFFLUENT VALVE NO. 2 CLOSE	DO		
Z-DI007..F27-F35	FILTER NO. 27 FILTER DRAIN VALVE OPENED	DI		
Z-DI008..F27-F35	FILTER NO. 27 FILTER DRAIN VALVE CLOSED	DI		
N-DO007..F27-F35	FILTER NO. 27 FILTER DRAIN VALVE OPEN	DO		
N-DO008..F27-F35	FILTER NO. 27 FILTER DRAIN VALVE CLOSE	DO		
Z-DI009..F27-F35	FILTER NO. 27 SURFACE WASH VALVE 1 OPENED	DI		
Z-DI010..F27-F35	FILTER NO. 27 SURFACE WASH VALVE 1 CLOSED	DI		
N-DO009..F27-F35	FILTER NO. 27 SURFACE WASH VALVE 1 OPEN/CLOSE	DO		
Z-DI011..F27-F35	FILTER NO. 27 SURFACE WASH VALVE 2 OPENED	DI		

INPUT/OUTPUT LIST

Tag	Description/Location	Type	Input from/Output to	Remarks/Drawing No.
Z-DI012..F27-F35	FILTER NO. 27 SURFACE WASH VALVE 2 CLOSED	DI		
N-DO010..F27-F35	FILTER NO. 27 SURFACE WASH VALVE 2 OPEN/CLOSE	DO		
Z-DI013..F27-F35	FILTER NO. 27 BACKWASH VALVE 1 OPENED	DI		
Z-DI014..F27-F35	FILTER NO. 27 BACKWASH VALVE 1 CLOSED	DI		
N-DO011..F27-F35	FILTER NO. 27 BACKWASH VALVE 1 OPEN/CLOSE	DO		
Z-DI015..F27-F35	FILTER NO. 27 BACKWASH VALVE 2 OPENED	DI		
Z-DI016..F27-F35	FILTER NO. 27 BACKWASH VALVE 2 CLOSED	DI		
N-DO012..F27-F35	FILTER NO. 27 BACKWASH VALVE 2 OPEN/CLOSE	DO		
Z-DI017..F27-F35	FILTER NO. 27 FILTER TO WASTE VALVE OPENED	DI		
Z-DI018..F27-F35	FILTER NO. 27 FILTER TO WASTE VALVE CLOSED	DI		
N-DO013..F27-F35	FILTER NO. 27 FILTER TO WASTE VALVE OPEN/CLOSE	DO		
A -AI003..F27-F35	FILTER NO. 27 TURBIDITY	AI		
F-AI001..F27-F35	FILTER NO. 27 EFFLUENT FLOW	AI		
Z-DI019..F27-F35	FILTER NO. 27 RATE CONTROL VALVE OPENED	DI		
Z-DI020..F27-F35	FILTER NO. 27 RATE CONTROL VALVE CLOSED	DI		
Z-AI004..F27-F35	FILTER NO. 27 RATE CONTROL VALVE POSITION	AI		
Z-AO001..F27-F35	FILTER NO. 27 RATE CONTROL VALVE POSITION	AO		
F-AI006..F27-F35	FILTER NO. 29 FILTER HEAD LOSS	AI		
Z-DI021..F27-F35	FILTER NO. 29 INFLUENT VALVE OPENED	DI		
Z-DI022..F27-F35	FILTER NO. 29 INFLUENT VALVE CLOSED	DI		
N-DO014..F27-F35	FILTER NO. 29 INFLUENT VALVE OPEN	DO		

INPUT/OUTPUT LIST

Tag	Description/Location	Type	Input from/Output to	Remarks/Drawing No.
N-DO015..F27-F35	FILTER NO. 29 INFLUENT VALVE CLOSE	DO		
Z-DI023..F27-F35	FILTER NO. 29 EFFLUENT VALVE NO. 1 OPENED	DI		
Z-DI024..F27-F35	FILTER NO. 29 EFFLUENT VALVE NO.1 CLOSED	DI		
N-DO016..F27-F35	FILTER NO. 29 EFFLUENT VALVE NO. 1 OPEN	DO		
N-DO017..F27-F35	FILTER NO. 29 EFFLUENT VALVE NO. 1 CLOSE	DO		
Z-DI025..F27-F35	FILTER NO. 29 EFFLUENT VALVE NO. 2 OPENED	DI		
Z-DI026..F27-F35	FILTER NO. 29 EFFLUENT VALVE NO.2 CLOSED	DI		
N-DO018..F27-F35	FILTER NO. 29 EFFLUENT VALVE NO. 2 OPEN	DO		
N-DO019..F27-F35	FILTER NO. 29 EFFLUENT VALVE NO. 2 CLOSE	DO		
Z-DI027..F27-F35	FILTER NO. 29 FILTER DRAIN VALVE OPENED	DI		
Z-DI028..F27-F35	FILTER NO. 29 FILTER DRAIN VALVE CLOSED	DI		
N-DO020..F27-F35	FILTER NO. 29 FILTER DRAIN VALVE OPEN	DO		
N-DO021..F27-F35	FILTER NO. 29 FILTER DRAIN VALVE CLOSE	DO		
Z-DI029..F27-F35	FILTER NO. 29 SURFACE WASH VALVE 1 OPENED	DI		
Z-DI030..F27-F35	FILTER NO. 29 SURFACE WASH VALVE 1 CLOSED	DI		
N-DO022..F27-F35	FILTER NO. 29 SURFACE WASH VALVE 1 OPEN/CLOSE	DO		
Z-DI031..F27-F35	FILTER NO. 29 SURFACE WASH VALVE 2 OPENED	DI		
Z-DI032..F27-F35	FILTER NO. 29 SURFACE WASH VALVE 2 CLOSED	DI		
N-DO023..F27-F35	FILTER NO. 29 SURFACE WASH VALVE 2 OPEN/CLOSE	DO		
Z-DI033..F27-F35	FILTER NO. 29 BACKWASH VALVE 1 OPENED	DI		
Z-DI034..F27-F35	FILTER NO. 29 BACKWASH VALVE 1 CLOSED	DI		

INPUT/OUTPUT LIST

Tag	Description/Location	Type	Input from/Output to	Remarks/Drawing No.
N-DO024..F27-F35	FILTER NO. 29 BACKWASH VALVE 1 OPEN/CLOSE	DO		
Z-DI035..F27-F35	FILTER NO. 29 BACKWASH VALVE 2 OPENED	DI		
Z-DI036..F27-F35	FILTER NO. 29 BACKWASH VALVE 2 CLOSED	DI		
N-DO025..F27-F35	FILTER NO. 29 BACKWASH VALVE 2 OPEN/CLOSE	DO		
Z-DI037..F27-F35	FILTER NO. 29 FILTER TO WASTE VALVE OPENED	DI		
Z-DI038..F27-F35	FILTER NO. 29 FILTER TO WASTE VALVE CLOSED	DI		
N-DO026..F27-F35	FILTER NO. 29 FILTER TO WASTE VALVE OPEN/CLOSE	DO		
A -AI007..F27-F35	FILTER NO. 29 TURBIDITY	AI		
F-AI005..F27-F35	FILTER NO. 29 EFFLUENT FLOW	AI		
Z-DI039..F27-F35	FILTER NO. 29 RATE CONTROL VALVE OPENED	DI		
Z-DI040..F27-F35	FILTER NO. 29 RATE CONTROL VALVE CLOSED	DI		
Z-AI008..F27-F35	FILTER NO. 29 RATE CONTROL VALVE POSITION	AI		
Z-AO002..F27-F35	FILTER NO. 29 RATE CONTROL VALVE POSITION	AO		
F-AI010..F27-F35	FILTER NO. 31 FILTER HEAD LOSS	AI		
Z-DI041..F27-F35	FILTER NO. 31 INFLUENT VALVE OPENED	DI		
Z-DI042..F27-F35	FILTER NO. 31 INFLUENT VALVE CLOSED	DI		
N-DO027..F27-F35	FILTER NO. 31 INFLUENT VALVE OPEN	DO		
N-DO028..F27-F35	FILTER NO. 31 INFLUENT VALVE CLOSE	DO		
Z-DI043..F27-F35	FILTER NO. 31 EFFLUENT VALVE NO. 1 OPENED	DI		
Z-DI044..F27-F35	FILTER NO. 31 EFFLUENT VALVE NO.1 CLOSED	DI		
N-DO029..F27-F35	FILTER NO. 31 EFFLUENT VALVE NO. 1 OPEN	DO		

INPUT/OUTPUT LIST

Tag	Description/Location	Type	Input from/Output to	Remarks/Drawing No.
N-DO030..F27-F35	FILTER NO. 31 EFFLUENT VALVE NO. 1 CLOSE	DO		
Z-DI045..F27-F35	FILTER NO. 31 EFFLUENT VALVE NO. 2 OPENED	DI		
Z-DI046..F27-F35	FILTER NO. 31 EFFLUENT VALVE NO.2 CLOSED	DI		
N-DO031..F27-F35	FILTER NO. 31 EFFLUENT VALVE NO. 2 OPEN	DO		
N-DO032..F27-F35	FILTER NO. 31 EFFLUENT VALVE NO. 2 CLOSE	DO		
Z-DI047..F27-F35	FILTER NO. 31 FILTER DRAIN VALVE OPENED	DI		
Z-DI048..F27-F35	FILTER NO. 31 FILTER DRAIN VALVE CLOSED	DI		
N-DO033..F27-F35	FILTER NO. 31 FILTER DRAIN VALVE OPEN	DO		
N-DO034..F27-F35	FILTER NO. 31 FILTER DRAIN VALVE CLOSE	DO		
Z-DI049..F27-F35	FILTER NO. 31 SURFACE WASH VALVE 1 OPENED	DI		
Z-DI050..F27-F35	FILTER NO. 31 SURFACE WASH VALVE 1 CLOSED	DI		
N-DO035..F27-F35	FILTER NO. 31 SURFACE WASH VALVE 1 OPEN/CLOSE	DO		
Z-DI051..F27-F35	FILTER NO. 31 SURFACE WASH VALVE 2 OPENED	DI		
Z-DI052..F27-F35	FILTER NO. 31 SURFACE WASH VALVE 2 CLOSED	DI		
N-DO036..F27-F35	FILTER NO. 31 SURFACE WASH VALVE 2 OPEN/CLOSE	DO		
Z-DI053..F27-F35	FILTER NO. 31 BACKWASH VALVE 1 OPENED	DI		
Z-DI054..F27-F35	FILTER NO. 31 BACKWASH VALVE 1 CLOSED	DI		
N-DO037..F27-F35	FILTER NO. 31 BACKWASH VALVE 1 OPEN/CLOSE	DO		
Z-DI055..F27-F35	FILTER NO. 31 BACKWASH VALVE 2 OPENED	DI		
Z-DI056..F27-F35	FILTER NO. 31 BACKWASH VALVE 2 CLOSED	DI		
N-DO038..F27-F35	FILTER NO. 31 BACKWASH VALVE 2 OPEN/CLOSE	DO		

INPUT/OUTPUT LIST

Tag	Description/Location	Type	Input from/Output to	Remarks/Drawing No.
Z-DI057..F27-F35	FILTER NO. 31 FILTER TO WASTE VALVE OPENED	DI		
Z-DI058..F27-F35	FILTER NO. 31 FILTER TO WASTE VALVE CLOSED	DI		
N-DO039..F27-F35	FILTER NO. 31 FILTER TO WASTE VALVE OPEN/CLOSE	DO		
A -AI011..F27-F35	FILTER NO. 31 TURBIDITY	AI		
F-AI009..F27-F35	FILTER NO. 31 EFFLUENT FLOW	AI		
Z-DI059..F27-F35	FILTER NO. 31 RATE CONTROL VALVE OPENED	DI		
Z-DI060..F27-F35	FILTER NO. 31 RATE CONTROL VALVE CLOSED	DI		
Z-AI012..F27-F35	FILTER NO. 31 RATE CONTROL VALVE POSITION	AI		
Z-AO003..F27-F35	FILTER NO. 31 RATE CONTROL VALVE POSITION	AO		
F-AI014..F27-F35	FILTER NO. 33 FILTER HEAD LOSS	AI		
Z-DI061..F27-F35	FILTER NO. 33 INFLUENT VALVE OPENED	DI		
Z-DI062..F27-F35	FILTER NO. 33 INFLUENT VALVE CLOSED	DI		
N-DO040..F27-F35	FILTER NO. 33 INFLUENT VALVE OPEN	DO		
N-DO041..F27-F35	FILTER NO. 33 INFLUENT VALVE CLOSE	DO		
Z-DI063..F27-F35	FILTER NO. 33 EFFLUENT VALVE NO. 1 OPENED	DI		
Z-DI064..F27-F35	FILTER NO. 33 EFFLUENT VALVE NO.1 CLOSED	DI		
N-DO042..F27-F35	FILTER NO. 33 EFFLUENT VALVE NO. 1 OPEN	DO		
N-DO043..F27-F35	FILTER NO. 33 EFFLUENT VALVE NO. 1 CLOSE	DO		
Z-DI065..F27-F35	FILTER NO. 33 EFFLUENT VALVE NO. 2 OPENED	DI		
Z-DI066..F27-F35	FILTER NO. 33 EFFLUENT VALVE NO.2 CLOSED	DI		
N-DO044..F27-F35	FILTER NO. 33 EFFLUENT VALVE NO. 2 OPEN	DO		

INPUT/OUTPUT LIST

Tag	Description/Location	Type	Input from/Output to	Remarks/Drawing No.
N-DO045..F27-F35	FILTER NO. 33 EFFLUENT VALVE NO. 2 CLOSE	DO		
Z-DI067..F27-F35	FILTER NO. 33 FILTER DRAIN VALVE OPENED	DI		
Z-DI068..F27-F35	FILTER NO. 33 FILTER DRAIN VALVE CLOSED	DI		
N-DO046..F27-F35	FILTER NO. 33 FILTER DRAIN VALVE OPEN	DO		
N-DO047..F27-F35	FILTER NO. 33 FILTER DRAIN VALVE CLOSE	DO		
Z-DI069..F27-F35	FILTER NO. 33 SURFACE WASH VALVE 1 OPENED	DI		
Z-DI070..F27-F35	FILTER NO. 33 SURFACE WASH VALVE 1 CLOSED	DI		
N-DO048..F27-F35	FILTER NO. 33 SURFACE WASH VALVE 1 OPEN/CLOSE	DO		
Z-DI071..F27-F35	FILTER NO. 33 SURFACE WASH VALVE 2 OPENED	DI		
Z-DI072..F27-F35	FILTER NO. 33 SURFACE WASH VALVE 2 CLOSED	DI		
N-DO049..F27-F35	FILTER NO. 33 SURFACE WASH VALVE 2 OPEN/CLOSE	DO		
Z-DI073..F27-F35	FILTER NO. 33 BACKWASH VALVE 1 OPENED	DI		
Z-DI074..F27-F35	FILTER NO. 33 BACKWASH VALVE 1 CLOSED	DI		
N-DO050..F27-F35	FILTER NO. 33 BACKWASH VALVE 1 OPEN/CLOSE	DO		
Z-DI075..F27-F35	FILTER NO. 33 BACKWASH VALVE 2 OPENED	DI		
Z-DI076..F27-F35	FILTER NO. 33 BACKWASH VALVE 2 CLOSED	DI		
N-DO051..F27-F35	FILTER NO. 33 BACKWASH VALVE 2 OPEN/CLOSE	DO		
Z-DI077..F27-F35	FILTER NO. 33 FILTER TO WASTE VALVE OPENED	DI		
Z-DI078..F27-F35	FILTER NO. 33 FILTER TO WASTE VALVE CLOSED	DI		
N-DO052..F27-F35	FILTER NO. 33 FILTER TO WASTE VALVE OPEN/CLOSE	DO		
A -AI015..F27-F35	FILTER NO. 33 TURBIDITY	AI		

INPUT/OUTPUT LIST

Tag	Description/Location	Type	Input from/Output to	Remarks/Drawing No.
F-AI013..F27-F35	FILTER NO. 33 EFFLUENT FLOW	AI		
Z-DI079..F27-F35	FILTER NO. 33 RATE CONTROL VALVE OPENED	DI		
Z-DI080..F27-F35	FILTER NO. 33 RATE CONTROL VALVE CLOSED	DI		
Z-AI016..F27-F35	FILTER NO. 33 RATE CONTROL VALVE POSITION	AI		
Z-AO004..F27-F35	FILTER NO. 33 RATE CONTROL VALVE POSITION	AO		
F-AI018..F27-F35	FILTER NO. 35 FILTER HEAD LOSS	AI		
Z-DI081..F27-F35	FILTER NO. 35 INFLUENT VALVE OPENED	DI		
Z-DI082..F27-F35	FILTER NO. 35 INFLUENT VALVE CLOSED	DI		
N-DO053..F27-F35	FILTER NO. 35 INFLUENT VALVE OPEN	DO		
N-DO054..F27-F35	FILTER NO. 35 INFLUENT VALVE CLOSE	DO		
Z-DI083..F27-F35	FILTER NO. 35 EFFLUENT VALVE NO. 1 OPENED	DI		
Z-DI084..F27-F35	FILTER NO. 35 EFFLUENT VALVE NO. 1 CLOSED	DI		
N-DO055..F27-F35	FILTER NO. 35 EFFLUENT VALVE NO. 1 OPEN	DO		
N-DO056..F27-F35	FILTER NO. 35 EFFLUENT VALVE NO. 1 CLOSE	DO		
Z-DI085..F27-F35	FILTER NO. 35 EFFLUENT VALVE NO. 2 OPENED	DI		
Z-DI086..F27-F35	FILTER NO. 35 EFFLUENT VALVE NO. 2 CLOSED	DI		
N-DO057..F27-F35	FILTER NO. 35 EFFLUENT VALVE NO. 2 OPEN	DO		
N-DO058..F27-F35	FILTER NO. 35 EFFLUENT VALVE NO. 2 CLOSE	DO		
Z-DI087..F27-F35	FILTER NO. 35 FILTER DRAIN VALVE OPENED	DI		
Z-DI088..F27-F35	FILTER NO. 35 FILTER DRAIN VALVE CLOSED	DI		
N-DO059..F27-F35	FILTER NO. 35 FILTER DRAIN VALVE OPEN	DO		

INPUT/OUTPUT LIST

Tag	Description/Location	Type	Input from/Output to	Remarks/Drawing No.
N-DO060..F27-F35	FILTER NO. 35 FILTER DRAIN VALVE CLOSE	DO		
Z-DI089..F27-F35	FILTER NO. 35 SURFACE WASH VALVE 1 OPENED	DI		
Z-DI090..F27-F35	FILTER NO. 35 SURFACE WASH VALVE 1 CLOSED	DI		
N-DO061..F27-F35	FILTER NO. 35 SURFACE WASH VALVE 1 OPEN/CLOSE	DO		
Z-DI091..F27-F35	FILTER NO. 35 SURFACE WASH VALVE 2 OPENED	DI		
Z-DI092..F27-F35	FILTER NO. 35 SURFACE WASH VALVE 2 CLOSED	DI		
N-DO062..F27-F35	FILTER NO. 35 SURFACE WASH VALVE 2 OPEN/CLOSE	DO		
Z-DI093..F27-F35	FILTER NO. 35 BACKWASH VALVE 1 OPENED	DI		
Z-DI094..F27-F35	FILTER NO. 35 BACKWASH VALVE 1 CLOSED	DI		
N-DO063..F27-F35	FILTER NO. 35 BACKWASH VALVE 1 OPEN/CLOSE	DO		
Z-DI095..F27-F35	FILTER NO. 35 BACKWASH VALVE 2 OPENED	DI		
Z-DI096..F27-F35	FILTER NO. 35 BACKWASH VALVE 2 CLOSED	DI		
N-DO064..F27-F35	FILTER NO. 35 BACKWASH VALVE 2 OPEN/CLOSE	DO		
Z-DI097..F27-F35	FILTER NO. 35 FILTER TO WASTE VALVE OPENED	DI		
Z-DI098..F27-F35	FILTER NO. 35 FILTER TO WASTE VALVE CLOSED	DI		
N-DO065..F27-F35	FILTER NO. 35 FILTER TO WASTE VALVE OPEN/CLOSE	DO		
A -AI019..F27-F35	FILTER NO. 35 TURBIDITY	AI		
F-AI017..F27-F35	FILTER NO. 35 EFFLUENT FLOW	AI		
Z-DI099..F27-F35	FILTER NO. 35 RATE CONTROL VALVE OPENED	DI		
Z-DI100..F27-F35	FILTER NO. 35 RATE CONTROL VALVE CLOSED	DI		
Z-AI020..F27-F35	FILTER NO. 35 RATE CONTROL VALVE POSITION	AI		

INPUT/OUTPUT LIST

Tag	Description/Location	Type	Input from/Output to	Remarks/Drawing No.
Z-AO005..F27-F35	FILTER NO. 35 RATE CONTROL VALVE POSITION	AO		
F-AI002..F28-F36	FILTER NO. 28 FILTER HEAD LOSS	AI		
Z-DI001..F28-F36	FILTER NO. 28 INFLUENT VALVE OPENED	DI		
Z-DI002..F28-F36	FILTER NO. 28 INFLUENT VALVE CLOSED	DI		
N-DO001..F28-F36	FILTER NO. 28 INFLUENT VALVE OPEN	DO		
N-DO002..F28-F36	FILTER NO. 28 INFLUENT VALVE CLOSE	DO		
Z-DI003..F28-F36	FILTER NO. 28 EFFLUENT VALVE NO. 1 OPENED	DI		
Z-DI004..F28-F36	FILTER NO. 28 EFFLUENT VALVE NO.1 CLOSED	DI		
N-DO003..F28-F36	FILTER NO. 28 EFFLUENT VALVE NO. 1 OPEN	DO		
N-DO004..F28-F36	FILTER NO. 28 EFFLUENT VALVE NO. 1 CLOSE	DO		
Z-DI005..F28-F36	FILTER NO. 28 EFFLUENT VALVE NO. 2 OPENED	DI		
Z-DI006..F28-F36	FILTER NO. 28 EFFLUENT VALVE NO.2 CLOSED	DI		
N-DO005..F28-F36	FILTER NO. 28 EFFLUENT VALVE NO. 2 OPEN	DO		
N-DO006..F28-F36	FILTER NO. 28 EFFLUENT VALVE NO. 2 CLOSE	DO		
Z-DI007..F28-F36	FILTER NO. 28 FILTER DRAIN VALVE OPENED	DI		
Z-DI008..F28-F36	FILTER NO. 28 FILTER DRAIN VALVE CLOSED	DI		
N-DO007..F28-F36	FILTER NO. 28 FILTER DRAIN VALVE OPEN	DO		
N-DO008..F28-F36	FILTER NO. 28 FILTER DRAIN VALVE CLOSE	DO		
Z-DI009..F28-F36	FILTER NO. 28 SURFACE WASH VALVE 1 OPENED	DI		
Z-DI010..F28-F36	FILTER NO. 28 SURFACE WASH VALVE 1 CLOSED	DI		
N-DO009..F28-F36	FILTER NO. 28 SURFACE WASH VALVE 1 OPEN/CLOSE	DO		

INPUT/OUTPUT LIST

Tag	Description/Location	Type	Input from/Output to	Remarks/Drawing No.
Z-DI011..F28-F36	FILTER NO. 28 SURFACE WASH VALVE 2 OPENED	DI		
Z-DI012..F28-F36	FILTER NO. 28 SURFACE WASH VALVE 2 CLOSED	DI		
N-DO010..F28-F36	FILTER NO. 28 SURFACE WASH VALVE 2 OPEN/CLOSE	DO		
Z-DI013..F28-F36	FILTER NO. 28 BACKWASH VALVE 1 OPENED	DI		
Z-DI014..F28-F36	FILTER NO. 28 BACKWASH VALVE 1 CLOSED	DI		
N-DO011..F28-F36	FILTER NO. 28 BACKWASH VALVE 1 OPEN/CLOSE	DO		
Z-DI015..F28-F36	FILTER NO. 28 BACKWASH VALVE 2 OPENED	DI		
Z-DI016..F28-F36	FILTER NO. 28 BACKWASH VALVE 2 CLOSED	DI		
N-DO012..F28-F36	FILTER NO. 28 BACKWASH VALVE 2 OPEN/CLOSE	DO		
Z-DI017..F28-F36	FILTER NO. 28 FILTER TO WASTE VALVE OPENED	DI		
Z-DI018..F28-F36	FILTER NO. 28 FILTER TO WASTE VALVE CLOSED	DI		
N-DO013..F28-F36	FILTER NO. 28 FILTER TO WASTE VALVE OPEN/CLOSE	DO		
A -AI003..F28-F36	FILTER NO. 28 TURBIDITY	AI		
F-AI001..F28-F36	FILTER NO. 28 EFFLUENT FLOW	AI		
Z-DI019..F28-F36	FILTER NO. 28 RATE CONTROL VALVE OPENED	DI		
Z-DI020..F28-F36	FILTER NO. 28 RATE CONTROL VALVE CLOSED	DI		
Z-AI004..F28-F36	FILTER NO. 28 RATE CONTROL VALVE POSITION	AI		
Z-AO001..F28-F36	FILTER NO. 28 RATE CONTROL VALVE POSITION	AO		
F-AI006..F28-F36	FILTER NO. 30 FILTER HEAD LOSS	AI		
Z-DI021..F28-F36	FILTER NO. 30 INFLUENT VALVE OPENED	DI		
Z-DI022..F28-F36	FILTER NO. 30 INFLUENT VALVE CLOSED	DI		

INPUT/OUTPUT LIST

Tag	Description/Location	Type	Input from/Output to	Remarks/Drawing No.
N-DO014..F28-F36	FILTER NO. 30 INFLUENT VALVE OPEN	DO		
N-DO015..F28-F36	FILTER NO. 30 INFLUENT VALVE CLOSE	DO		
Z-DI023..F28-F36	FILTER NO. 30 EFFLUENT VALVE NO. 1 OPENED	DI		
Z-DI024..F28-F36	FILTER NO. 30 EFFLUENT VALVE NO.1 CLOSED	DI		
N-DO016..F28-F36	FILTER NO. 30 EFFLUENT VALVE NO. 1 OPEN	DO		
N-DO017..F28-F36	FILTER NO. 30 EFFLUENT VALVE NO. 1 CLOSE	DO		
Z-DI025..F28-F36	FILTER NO. 30 EFFLUENT VALVE NO. 2 OPENED	DI		
Z-DI026..F28-F36	FILTER NO. 30 EFFLUENT VALVE NO.2 CLOSED	DI		
N-DO018..F28-F36	FILTER NO. 30 EFFLUENT VALVE NO. 2 OPEN	DO		
N-DO019..F28-F36	FILTER NO. 30 EFFLUENT VALVE NO. 2 CLOSE	DO		
Z-DI027..F28-F36	FILTER NO. 30 FILTER DRAIN VALVE OPENED	DI		
Z-DI028..F28-F36	FILTER NO. 30 FILTER DRAIN VALVE CLOSED	DI		
N-DO020..F28-F36	FILTER NO. 30 FILTER DRAIN VALVE OPEN	DO		
N-DO021..F28-F36	FILTER NO. 30 FILTER DRAIN VALVE CLOSE	DO		
Z-DI029..F28-F36	FILTER NO. 30 SURFACE WASH VALVE 1 OPENED	DI		
Z-DI030..F28-F36	FILTER NO. 30 SURFACE WASH VALVE 1 CLOSED	DI		
N-DO022..F28-F36	FILTER NO. 30 SURFACE WASH VALVE 1 OPEN/CLOSE	DO		
Z-DI031..F28-F36	FILTER NO. 30 SURFACE WASH VALVE 2 OPENED	DI		
Z-DI032..F28-F36	FILTER NO. 30 SURFACE WASH VALVE 2 CLOSED	DI		
N-DO023..F28-F36	FILTER NO. 30 SURFACE WASH VALVE 2 OPEN/CLOSE	DO		
Z-DI033..F28-F36	FILTER NO. 30 BACKWASH VALVE 1 OPENED	DI		

INPUT/OUTPUT LIST

Tag	Description/Location	Type	Input from/Output to	Remarks/Drawing No.
Z-DI034..F28-F36	FILTER NO. 30 BACKWASH VALVE 1 CLOSED	DI		
N-DO024..F28-F36	FILTER NO. 30 BACKWASH VALVE 1 OPEN/CLOSE	DO		
Z-DI035..F28-F36	FILTER NO. 30 BACKWASH VALVE 2 OPENED	DI		
Z-DI036..F28-F36	FILTER NO. 30 BACKWASH VALVE 2 CLOSED	DI		
N-DO025..F28-F36	FILTER NO. 30 BACKWASH VALVE 2 OPEN/CLOSE	DO		
Z-DI037..F28-F36	FILTER NO. 30 FILTER TO WASTE VALVE OPENED	DI		
Z-DI038..F28-F36	FILTER NO. 30 FILTER TO WASTE VALVE CLOSED	DI		
N-DO026..F28-F36	FILTER NO. 30 FILTER TO WASTE VALVE OPEN/CLOSE	DO		
A -AI007..F28-F36	FILTER NO. 30 TURBIDITY	AI		
F-AI005..F28-F36	FILTER NO. 30 EFFLUENT FLOW	AI		
Z-DI039..F28-F36	FILTER NO. 30 RATE CONTROL VALVE OPENED	DI		
Z-DI040..F28-F36	FILTER NO. 30 RATE CONTROL VALVE CLOSED	DI		
Z-AI008..F28-F36	FILTER NO. 30 RATE CONTROL VALVE POSITION	AI		
Z-AO002..F28-F36	FILTER NO. 30 RATE CONTROL VALVE POSITION	AO		
F-AI010..F28-F36	FILTER NO. 32 FILTER HEAD LOSS	AI		
Z-DI041..F28-F36	FILTER NO. 32 INFLUENT VALVE OPENED	DI		
Z-DI042..F28-F36	FILTER NO. 32 INFLUENT VALVE CLOSED	DI		
N-DO027..F28-F36	FILTER NO. 32 INFLUENT VALVE OPEN	DO		
N-DO028..F28-F36	FILTER NO. 32 INFLUENT VALVE CLOSE	DO		
Z-DI043..F28-F36	FILTER NO. 32 EFFLUENT VALVE NO. 1 OPENED	DI		
Z-DI044..F28-F36	FILTER NO. 32 EFFLUENT VALVE NO.1 CLOSED	DI		

INPUT/OUTPUT LIST

Tag	Description/Location	Type	Input from/Output to	Remarks/Drawing No.
N-DO029..F28-F36	FILTER NO. 32 EFFLUENT VALVE NO. 1 OPEN	DO		
N-DO030..F28-F36	FILTER NO. 32 EFFLUENT VALVE NO. 1 CLOSE	DO		
Z-DI045..F28-F36	FILTER NO. 32 EFFLUENT VALVE NO. 2 OPENED	DI		
Z-DI046..F28-F36	FILTER NO. 32 EFFLUENT VALVE NO. 2 CLOSED	DI		
N-DO031..F28-F36	FILTER NO. 32 EFFLUENT VALVE NO. 2 OPEN	DO		
N-DO032..F28-F36	FILTER NO. 32 EFFLUENT VALVE NO. 2 CLOSE	DO		
Z-DI047..F28-F36	FILTER NO. 32 FILTER DRAIN VALVE OPENED	DI		
Z-DI048..F28-F36	FILTER NO. 32 FILTER DRAIN VALVE CLOSED	DI		
N-DO033..F28-F36	FILTER NO. 32 FILTER DRAIN VALVE OPEN	DO		
N-DO034..F28-F36	FILTER NO. 32 FILTER DRAIN VALVE CLOSE	DO		
Z-DI049..F28-F36	FILTER NO. 32 SURFACE WASH VALVE 1 OPENED	DI		
Z-DI050..F28-F36	FILTER NO. 32 SURFACE WASH VALVE 1 CLOSED	DI		
N-DO035..F28-F36	FILTER NO. 32 SURFACE WASH VALVE 1 OPEN/CLOSE	DO		
Z-DI051..F28-F36	FILTER NO. 32 SURFACE WASH VALVE 2 OPENED	DI		
Z-DI052..F28-F36	FILTER NO. 32 SURFACE WASH VALVE 2 CLOSED	DI		
N-DO036..F28-F36	FILTER NO. 32 SURFACE WASH VALVE 2 OPEN/CLOSE	DO		
Z-DI053..F28-F36	FILTER NO. 32 BACKWASH VALVE 1 OPENED	DI		
Z-DI054..F28-F36	FILTER NO. 32 BACKWASH VALVE 1 CLOSED	DI		
N-DO037..F28-F36	FILTER NO. 32 BACKWASH VALVE 1 OPEN/CLOSE	DO		
Z-DI055..F28-F36	FILTER NO. 32 BACKWASH VALVE 2 OPENED	DI		
Z-DI056..F28-F36	FILTER NO. 32 BACKWASH VALVE 2 CLOSED	DI		

INPUT/OUTPUT LIST

Tag	Description/Location	Type	Input from/Output to	Remarks/Drawing No.
N-DO038..F28-F36	FILTER NO. 32 BACKWASH VALVE 2 OPEN/CLOSE	DO		
Z-DI057..F28-F36	FILTER NO. 32 FILTER TO WASTE VALVE OPENED	DI		
Z-DI058..F28-F36	FILTER NO. 32 FILTER TO WASTE VALVE CLOSED	DI		
N-DO039..F28-F36	FILTER NO. 32 FILTER TO WASTE VALVE OPEN/CLOSE	DO		
A -AI011..F28-F36	FILTER NO. 32 TURBIDITY	AI		
F-AI009..F28-F36	FILTER NO. 32 EFFLUENT FLOW	AI		
Z-DI059..F28-F36	FILTER NO. 32 RATE CONTROL VALVE OPENED	DI		
Z-DI060..F28-F36	FILTER NO. 32 RATE CONTROL VALVE CLOSED	DI		
Z-AI012..F28-F36	FILTER NO. 32 RATE CONTROL VALVE POSITION	AI		
Z-AO003..F28-F36	FILTER NO. 32 RATE CONTROL VALVE POSITION	AO		
F-AI014..F28-F36	FILTER NO. 34 FILTER HEAD LOSS	AI		
Z-DI061..F28-F36	FILTER NO. 34 INFLUENT VALVE OPENED	DI		
Z-DI062..F28-F36	FILTER NO. 34 INFLUENT VALVE CLOSED	DI		
N-DO040..F28-F36	FILTER NO. 34 INFLUENT VALVE OPEN	DO		
N-DO041..F28-F36	FILTER NO. 34 INFLUENT VALVE CLOSE	DO		
Z-DI063..F28-F36	FILTER NO. 34 EFFLUENT VALVE NO. 1 OPENED	DI		
Z-DI064..F28-F36	FILTER NO. 34 EFFLUENT VALVE NO.1 CLOSED	DI		
N-DO042..F28-F36	FILTER NO. 34 EFFLUENT VALVE NO. 1 OPEN	DO		
N-DO043..F28-F36	FILTER NO. 34 EFFLUENT VALVE NO. 1 CLOSE	DO		
Z-DI065..F28-F36	FILTER NO. 34 EFFLUENT VALVE NO. 2 OPENED	DI		
Z-DI066..F28-F36	FILTER NO. 34 EFFLUENT VALVE NO.2 CLOSED	DI		

INPUT/OUTPUT LIST

Tag	Description/Location	Type	Input from/Output to	Remarks/Drawing No.
N-DO044..F28-F36	FILTER NO. 34 EFFLUENT VALVE NO. 2 OPEN	DO		
N-DO045..F28-F36	FILTER NO. 34 EFFLUENT VALVE NO. 2 CLOSE	DO		
Z-DI067..F28-F36	FILTER NO. 34 FILTER DRAIN VALVE OPENED	DI		
Z-DI068..F28-F36	FILTER NO. 34 FILTER DRAIN VALVE CLOSED	DI		
N-DO046..F28-F36	FILTER NO. 34 FILTER DRAIN VALVE OPEN	DO		
N-DO047..F28-F36	FILTER NO. 34 FILTER DRAIN VALVE CLOSE	DO		
Z-DI069..F28-F36	FILTER NO. 34 SURFACE WASH VALVE 1 OPENED	DI		
Z-DI070..F28-F36	FILTER NO. 34 SURFACE WASH VALVE 1 CLOSED	DI		
N-DO048..F28-F36	FILTER NO. 34 SURFACE WASH VALVE 1 OPEN/CLOSE	DO		
Z-DI071..F28-F36	FILTER NO. 34 SURFACE WASH VALVE 2 OPENED	DI		
Z-DI072..F28-F36	FILTER NO. 34 SURFACE WASH VALVE 2 CLOSED	DI		
N-DO049..F28-F36	FILTER NO. 34 SURFACE WASH VALVE 2 OPEN/CLOSE	DO		
Z-DI073..F28-F36	FILTER NO. 34 BACKWASH VALVE 1 OPENED	DI		
Z-DI074..F28-F36	FILTER NO. 34 BACKWASH VALVE 1 CLOSED	DI		
N-DO050..F28-F36	FILTER NO. 34 BACKWASH VALVE 1 OPEN/CLOSE	DO		
Z-DI075..F28-F36	FILTER NO. 34 BACKWASH VALVE 2 OPENED	DI		
Z-DI076..F28-F36	FILTER NO. 34 BACKWASH VALVE 2 CLOSED	DI		
N-DO051..F28-F36	FILTER NO. 34 BACKWASH VALVE 2 OPEN/CLOSE	DO		
Z-DI077..F28-F36	FILTER NO. 34 FILTER TO WASTE VALVE OPENED	DI		
Z-DI078..F28-F36	FILTER NO. 34 FILTER TO WASTE VALVE CLOSED	DI		
N-DO052..F28-F36	FILTER NO. 34 FILTER TO WASTE VALVE OPEN/CLOSE	DO		

INPUT/OUTPUT LIST

Tag	Description/Location	Type	Input from/Output to	Remarks/Drawing No.
A -AI015..F28-F36	FILTER NO. 34 TURBIDITY	AI		
F-AI013..F28-F36	FILTER NO. 34 EFFLUENT FLOW	AI		
Z-DI079..F28-F36	FILTER NO. 34 RATE CONTROL VALVE OPENED	DI		
Z-DI080..F28-F36	FILTER NO. 34 RATE CONTROL VALVE CLOSED	DI		
Z-AI016..F28-F36	FILTER NO. 34 RATE CONTROL VALVE POSITION	AI		
Z-AO004..F28-F36	FILTER NO. 34 RATE CONTROL VALVE POSITION	AO		
F-AI018..F28-F36	FILTER NO. 36 FILTER HEAD LOSS	AI		
Z-DI081..F28-F36	FILTER NO. 36 INFLUENT VALVE OPENED	DI		
Z-DI082..F28-F36	FILTER NO. 36 INFLUENT VALVE CLOSED	DI		
N-DO053..F28-F36	FILTER NO. 36 INFLUENT VALVE OPEN	DO		
N-DO054..F28-F36	FILTER NO. 36 INFLUENT VALVE CLOSE	DO		
Z-DI083..F28-F36	FILTER NO. 36 EFFLUENT VALVE NO. 1 OPENED	DI		
Z-DI084..F28-F36	FILTER NO. 36 EFFLUENT VALVE NO.1 CLOSED	DI		
N-DO055..F28-F36	FILTER NO. 36 EFFLUENT VALVE NO. 1 OPEN	DO		
N-DO056..F28-F36	FILTER NO. 36 EFFLUENT VALVE NO. 1 CLOSE	DO		
Z-DI085..F28-F36	FILTER NO. 36 EFFLUENT VALVE NO. 2 OPENED	DI		
Z-DI086..F28-F36	FILTER NO. 36 EFFLUENT VALVE NO.2 CLOSED	DI		
N-DO057..F28-F36	FILTER NO. 36 EFFLUENT VALVE NO. 2 OPEN	DO		
N-DO058..F28-F36	FILTER NO. 36 EFFLUENT VALVE NO. 2 CLOSE	DO		
Z-DI087..F28-F36	FILTER NO. 36 FILTER DRAIN VALVE OPENED	DI		
Z-DI088..F28-F36	FILTER NO. 36 FILTER DRAIN VALVE CLOSED	DI		

INPUT/OUTPUT LIST

Tag	Description/Location	Type	Input from/Output to	Remarks/Drawing No.
N-DO059..F28-F36	FILTER NO. 36 FILTER DRAIN VALVE OPEN	DO		
N-DO060..F28-F36	FILTER NO. 36 FILTER DRAIN VALVE CLOSE	DO		
Z-DI089..F28-F36	FILTER NO. 36 SURFACE WASH VALVE 1 OPENED	DI		
Z-DI090..F28-F36	FILTER NO. 36 SURFACE WASH VALVE 1 CLOSED	DI		
N-DO061..F28-F36	FILTER NO. 36 SURFACE WASH VALVE 1 OPEN/CLOSE	DO		
Z-DI091..F28-F36	FILTER NO. 36 SURFACE WASH VALVE 2 OPENED	DI		
Z-DI092..F28-F36	FILTER NO. 36 SURFACE WASH VALVE 2 CLOSED	DI		
N-DO062..F28-F36	FILTER NO. 36 SURFACE WASH VALVE 2 OPEN/CLOSE	DO		
Z-DI093..F28-F36	FILTER NO. 36 BACKWASH VALVE 1 OPENED	DI		
Z-DI094..F28-F36	FILTER NO. 36 BACKWASH VALVE 1 CLOSED	DI		
N-DO063..F28-F36	FILTER NO. 36 BACKWASH VALVE 1 OPEN/CLOSE	DO		
Z-DI095..F28-F36	FILTER NO. 36 BACKWASH VALVE 2 OPENED	DI		
Z-DI096..F28-F36	FILTER NO. 36 BACKWASH VALVE 2 CLOSED	DI		
N-DO064..F28-F36	FILTER NO. 36 BACKWASH VALVE 2 OPEN/CLOSE	DO		
Z-DI097..F28-F36	FILTER NO. 36 FILTER TO WASTE VALVE OPENED	DI		
Z-DI098..F28-F36	FILTER NO. 36 FILTER TO WASTE VALVE CLOSED	DI		
N-DO065..F28-F36	FILTER NO. 36 FILTER TO WASTE VALVE OPEN/CLOSE	DO		
A -AI019..F28-F36	FILTER NO. 36 TURBIDITY	AI		
F-AI017..F28-F36	FILTER NO. 36 EFFLUENT FLOW	AI		
Z-DI099..F28-F36	FILTER NO. 36 RATE CONTROL VALVE OPENED	DI		
Z-DI100..F28-F36	FILTER NO. 36 RATE CONTROL VALVE CLOSED	DI		

INPUT/OUTPUT LIST

Tag	Description/Location	Type	Input from/Output to	Remarks/Drawing No.
Z-AI020..F28-F36	FILTER NO. 36 RATE CONTROL VALVE POSITION	AI		
Z-AO005..F28-F36	FILTER NO. 36 RATE CONTROL VALVE POSITION	AO		
F -AI021..F27-F35	MASTER BACKWASH FLOW	AI		
Z-DI102...F27-F35	MASTER BACKWASH VALVE OPENED	DI		
Z-DI103..F27-F35	MASTER BACKWASH VALVE CLOSED	DI		
Z-AI022...F27-F35	MASTER BACKWASH VALVE POSITION	AI		
Z-AO006.F27-F35	MASTER BACKWASH VALVE POSITION	AO		
Y-DI101..F27-F35	MASTER BACKWASH VALVE NOT IN REMOTE	DI		
F -AI021..F28-F36	MASTER BACKWASH FLOW	AI		
Z-DI102..F28-F36	MASTER BACKWASH VALVE OPENED	DI		
Z-DI103..F28-F36	MASTER BACKWASH VALVE CLOSED	DI		
Z-AI022...F28-F36	MASTER BACKWASH VALVE POSITION	AI		
Z-AO006.F28-F36	MASTER BACKWASH VALVE POSITION	AO		
Y-DI101..F28-F36	MASTER BACKWASH VALVE NOT IN REMOTE	DI		
Y-DI104..F27-F35	PURGE COMPRESSOR NO. 1 RUNNING	DI		
I-DI105..F27-F35	PURGE COMPRESSOR NO. 1 OVERLOAD	DI		
Y-DI106..F27-F35	PURGE COMPRESSOR NO. 2 RUNNING	DI		
I-DI107..F27-F35	PURGE COMPRESSOR NO. 2 OVERLOAD	DI		
P-DI108..F27-F35	PURGE AIR LOW PRESSURE ALARM	DI		
P-DI109..F27-F35	PURGE AIR HIGH PRESSURE ALARM	DI		
T-DI110...F27-F35	PURGE AIR HIGH TEMPERATURE ALARM	DI		

SECTION 13660

INSTRUMENTATION AND CONTROL SYSTEM
CONTROL DESCRIPTIONS

PART 1 GENERAL

1.1 SCOPE OF WORK

1.1.1 Provide all labor, materials, equipment and incidentals as shown, specified, and required to configure the West Filter Building SCADA and existing Central SCADA systems to accomplish the functionality specified herein.

1.1.2 Configuration and documentation of the combined SCADA System - shall be performed by the supplier, to provide complete functionality as shown on the drawings and specified in the instrumentation and control system specification Sections 13621 through 13660.

PART 2 PRODUCTS
NOT APPLICABLE

PART 3 EXECUTION

3.1 PROCESS GRAPHICS

3.1.1 The Operator Interface for the system shall include, but not be limited to, the Existing Plant SCADA Computers, and the new operator interface terminals (OITs) at the two Local Operator Panels (LOPs). The existing central SCADA includes one existing computer (DMM1-CRT) that is used to monitor all of the Filters in the Plant. This CRT runs a Windows 2000 based version of Genesis 32 human-machine interface software as manufactured by Iconics.

3.1.2 SCADA system computers and OITs are to contain process graphics, and faceplates to allow operator interface with the equipment. The layout and symbology on the process graphics should be similar to the existing graphic representation on the existing central SCADA and that shown on the P&IDs. The graphics are to contain dynamic symbols representing the status of equipment. Running equipment and opened valves are to be represented in Red. Stopped equipment and closed valves are to be represented in Green. Equipment in alarm is to be represented in Amber.

3.1.3 In general, each process graphic is to represent the status, alarm, and other control information as indicated on the P&IDs, and as required herein. The P&IDs do not represent all of the functionality for non-process equipment. The I/O list shows the additional non-process I/O points to be configured. It is required that each process graphic includes, at a minimum, the following:

3.1.3.1 Control faceplates to accomplish the control functionality as specified and as indicated on the P&IDs. Faceplates are to pop up when selected by the operator.

3.1.3.2 Trend Displays showing all the analog values associated with the particular process graphic.

3.1.3.3 Common Alarm Display indicating the status of all alarms associated with the specific equipment on the graphic.

3.1.3.4 All analog values shall be displayed with high, high-high, low, and low-low alarm indication.

3.1.4 The following describes the anticipated process graphics for the system. These graphics are to be provided at the existing central SCADA CRT and replicated at each of the LOPs. The graphics at the LOPs shall have the same look and feel as at the CRT except that the LOPs shall only represent the information for the West Filters.

3.1.4.1 Existing Central SCADA Graphics:

The existing central SCADA system contains the following graphics:

- a. Filtration Summary Screen that represents the analog information for the filters in the west building and the east building.
- b. West Filter Data screen that indicates the headloss, flow, turbidity, rate set, run time and other pertinent information for each filter.
- c. Filter % of rate set screen, where the operators can set filters in and out of service and set filtration rates.

These screens are to be retained under this contract. The supplier shall reconfigure these screens to show the information for the West Filters. Each of these screens is to include a pickpoint for each filter that provides a link to a new graphic screen for that filter.

3.1.4.2 New Graphics

Provide the following new graphics at the Central SCADA System and at the LOPs:

- a. Filter Graphic
Provide a filter graphic for each filter. Show all information for the filter as shown on the applicable P&ID. The filter graphic shall be a graphical representation of the filter similar to the layout shown on the P&ID.
- b. Filter Control Graphic
Include all controls and faceplates to support filter rate control and backwash control.
- c. Purge Air Graphic
The Purge Air Graphic is to show the information related to the Purge Air System. The graphic shall show all monitoring signals for the Purge Air System as shown on the applicable P&ID.
- d. Additional graphics
Assume 5 other graphics as directed by owner.

3.2 FILTER CONTROL DESCRIPTIONS

3.2.1 General

The P&IDs represent the process monitoring and control required. The required control for the system is a combination of the representation on the P&IDs and the requirements specified herein. The P&IDs do not show all the required internal diagnostic indications. In addition, to the indications shown on the P&IDs, the following, at a minimum, shall be provided.

3.2.1.1 Indication of bad quality on any hard wired input/output point (such as zero milliamps on a 4-20 milliamp circuit).

3.2.1.2 Individual Distributed Process Controller (DPC) fault indications identifying any DPC on the network that has faulted.

3.2.1.3 Indication of a communications failure with any other DPC on the Network and of the link to the Central SCADA computers. This must individually identify the broken link to assist troubleshooting.

3.2.1.4 Indication of a power failure at any other DPC on the network and of the link to the Central SCADA computers. This must individually identify the broken link to assist troubleshooting.

3.2.1.5 For all motor start and valve open/close commands check for run feedback after adjustable time delay (0-30 seconds). Set bad start bit in the DPC if unit fails to run or open/close. Use the bad start bit to remove the run command from the DPC and indicate bad start for that equipment at Central SCADA Computer.

3.2.1.6 For analog control loops, when control of field equipment is not in computer, the associated PID controller output shall track the position feedback.

3.2.2 Filter Controls (Sheet I-2)

3.2.2.1 Central SCADA Control. An LOP/SCADA selection switch shall be configured at each LOP. This switch is to serve to transfer control of the filters to the central SCADA CRT.

3.2.2.2 Influent/Effluent/Filter Drain Valves (Non-modulating/Upon failure hold last position)

- a. Local Control: Each Influent/Effluent valve shall be provided with a manual bypass switch at the associated solenoid valve for emergency operation.
- b. LOP Control: A Manual/Auto switch shall be configured for each non-modulating valve and shall be programmed at the associated LOP. In Manual, the valve shall be opened and closed from the associated LOP. In Auto, the valve shall be controlled according to the Backwash Control Strategy outlined below.
- c. Central SCADA Control: The control modes at SCADA, when permitted, are identical to those specified for the LOPs.

3.2.2.3 Fail Closed Valves (Non modulating)

- a. Local Control: Each Fail Closed valve shall be provided with a manual bypass on the associated solenoid valves for emergency operation.
- b. LOP Control: A Manual/Auto switch shall be provided at the LOPs. In Manual, the valve shall be opened and closed from either LOPs. In Auto, the valve shall be controlled according to the Backwash Control Strategy.
- c. Central SCADA Control. The control modes at SCADA, when permitted, are identical to those specified for the LOPs.

3.2.2.4 Filter Rate Control Valve (Modulating)

- a. Local Control: Each Filter Rate Control Valve shall have a local pneumatic controller that will allow local throttling of the valve when desired. This pneumatic controller is to be in parallel with the valve I/P controller. Under normal conditions, the valve will be controlled by a flow controller in the associated DPC.
- b. LOP Control: Each LOP shall be configured with Manual/Auto switch and a Local/Remote switch for its associated Filter Rate Control Valve. In Local/Manual mode the Operator shall enter the desired valve position at the LOP. The automatic modes are described as part of the Automatic Filter Flow Control strategy defined later in this section.
- c. In any mode when the filter effluent valves are closed for backwashing the controller will be forced to hold with a zero output until it is reopened at the end of the backwash cycle.
- d. The control modes at SCADA, when permitted by the LOP/SCADA switch, are identical to those specified for the LOPs.

3.2.2.5 Master Backwash Valve (Modulating)

- a. Local Control: The Master Backwash Valve shall have a local electronic PID controller that will facilitate throttling of the valve. The controller shall have both Auto/Manual and Local/Remote selectors. In Local, the PID controller mode will be based on the Auto/Manual selector switch. In Local/Auto, the PID controller will position the valve to maintain the desired backwash flow setpoint. In Local/Manual, the operator manually sets the valve position from the controller. In Remote, the controller will pass the output from the SCADA to the valve.
- b. LOP Control: A Manual/Auto switch shall be provided at the associated LOP. In Manual, the desired valve position is entered from the LOP. In Auto, a PID flow controller output shall position the effluent valve to maintain a backwash rate set from the Backwash Control Strategy.

- e. The control modes at SCADA, when permitted by the LOP/SCADA switch, are identical to those specified for the LOPs.

3.2.2.6 Backwash Control Strategy

The backwash cycle shall be manually initiated at the LOP or, if control is enabled, from the Central SCADA System. The operation of the backwash cycle shall be configured with automatic and semi-automatic modes based on a selection made by the operator. Automatic mode is based on the following sequence. Semi-automatic mode uses the same sequence except that the operator manually advances each step. If at any time, the valve position confirmation is not received or the desired flowrate is not achieved by a preset time, the automatic backwash sequence shall be paused and an alarm initiated.

- a. Step 1: Close the Filter Rate Control Valve.
- b. Step 2: Then close the Influent Valve. Then close the two Effluent Valves.
- c. Step 3: Open the Filter Drain valve.
- d. Step 4: When the filter has drained (based on time and/or level), open the Surface Wash Valve 1.
- e. Step 5: Five minutes (adjustable) after opening surface wash valve, open Backwash Valve 1.
- f. Step 6: Set backwash rate setter to 10 mgd (adjustable). The ramp time to reach the low backwash rate is one minute (adjustable).
- g. Step 7: Five minutes (adjustable) after the backwash rate reaches 10 MGD, close Surface Wash Valve 1.
- h. Step 8: When surface wash reaches the close position, then increase backwash rate to operator setpoint (adjustable). The ramp time to reach the high backwash rate is two minutes (adjustable). Keep backwashing at this rate until an operator selectable time has expired. The high backwash rate period may be extended by a designated extend time or advanced to the next step by the operator from the OIT (or control room if enabled). The cycle can also be kept in backwash by selecting pause.
- i. Step 9: Open the Surface Wash Valve 2 prior to the end of the high backwash rate cycle time.
- j. Step 10: Five minutes (adjustable) after opening the Surface Wash Valve 2 and after the completion of the high backwash rate cycle in Step 8, decrease the backwash flow to 10 MGD. The ramp time to reach the low backwash rate is one minute (adjustable).
- k. Step 11: Two minutes (adjustable) after decreasing the backwash flow to 10 MGD, open Backwash Valve 2 and close Backwash Valve 1.

- l. Step 12: Five minutes (adjustable) after closing Backwash Valve 1, close Surface Wash Valve 2. When Surface Wash Valve 2 reaches the close position, then set backwash rate as described in Step 8. The backwash period may be extended by a designated extend time or advanced to the next step by the operator from the OIT (or control room if enabled). The cycle can also be kept in backwash by selecting pause.
 - m. Step 13: Decrease the backwash flow to 10 mgd. The ramp time to reach the low backwash rate is one minute (adjustable).
 - n. Step 14: Two minutes (adjustable) after decreasing the backwash flow to 10 MGD, slowly return backwash rate setter to zero and close Backwash Valve 2.
 - o. Step 15: Close the Drain Valve.
 - p. Step 16: Open the Influent Valve.
 - q. Step 17: When the filter is full, open the two Effluent Valves based on time, operator acknowledgement and level indication.
 - r. Step 18: Open the Filter to Waste valve and waste based on the selected waste mode. In time mode waste for 30 minutes. In turbidity mode, waste until the turbidity reaches 0.1 NTU. In combined mode, it is based on whichever of these is reached first.
 - s. Step 19: After wasting cycle is completed, close the Filter Waste Valve and let filter sit.
 - t. Step 20: After 30 minutes, set the Filter Rate Control Valve to 25%.
 - u. Step 21: Wait 5 minutes (adjustable) and then slowly increase to desired flow.
- 3.2.2.7 Backwash Control Interlocks
- a. Backwash controls will interlock with the backwash master controller and effluent rate controllers as required to support the backwash sequence above.
 - b. Automatic backwash shall only be allowed if all of the valves for a given filter are available for control by the Central SCADA System.
 - c. If any valve fails to travel as directed by the strategy, the backwashing sequence will alarm and enter a pause state. Advancing to the next step shall only be possible if the alarm is cleared and reset by the Operator.
 - d. Provide interlocks to ensure that only one filter can be in backwash mode at any given time.

- e. If the automatic backwash sequence is aborted, all filter valves and the backwash master control valve shall be closed, and a flashing alarm message shall be activated at the LOPs and the SCADA CRT.

3.2.2.8 Automatic filter flow control

a. LOP Automatic Control:

- 1) When the Filter Rate Control Valve Auto/Manual selector switch is in the Auto position, the Filter Rate Control Valve controller positions the Filter Rate Control Valve as determined by the flow controller Local/Remote operating mode and operator entered setpoints. The controller Local/Remote mode shall be selected at the LOP.
- 2) When the flow controller is in the Auto/Local mode, the controller shall position the Filter Rate Control Valve to maintain a flow setpoint entered by the Operator.
- 3) When the filter effluent flow controller is in the Auto/Remote mode, the Central SCADA System provides a flow setpoint signal to the flow controller to position the Filter Rate Control Valve. The SCADA system calculates the filter flow setpoint by either a total flow or an automatic level mode as selected by the Operator and described below.
- 4) Total filter flow: When total filter flow mode is selected, the SCADA system at the existing DMM1 cabinet shall be configured to calculate the common filter flow setpoint by dividing the Operator entered total flow setpoint by the number of filters in service. If one or more filters are controlled manually, the SCADA system subtracts the flow from the filters that are not in automatic before calculating the common filter flow setpoint, thereby maintaining the operator selected total filter flow.
- 5) Auto level control: When filter level control mode is selected, the SCADA system adjusts the total filter flow setpoint (for use by all in service filters) to maintain an operator entered level setpoint in the filter influent flume. A common level controller shall be configured at DMM1. The output of this controller shall increase or decrease the total flow setpoint to maintain the filter influent flume level within a range of approximately plus or minus three inches of the setpoint. The system sends the adjusted setpoint to all filters which are in service, thereby equally distributing the total plant flow to all filters in service and automatically adjusting the filter flows when a filter is taken out of service or placed back in service or the plant flow is changed. The SCADA system shall generate an alarm if the level in the filter influent flume deviates from the setpoint by more than four inches.

- b. Central SCADA Control: Central SCADA control, when enabled is identical to that of LOP control.

3.3 EBS FLUSHING CONTROL DESCRIPTIONS

3.3.1 The required control for the Emergency Backwash System (EBS) Flushing System is as specified herein.

3.3.2 EBS Flushing System Controls

3.3.2.1 EBS Flushing Line Solenoid Valves

- a. Local Control: An Open-Auto-Close switch shall be provided for each valve on the EBS Flushing System Control Panel. In the "Open" position, the solenoid valve will open allowing water to discharge through the flushing line. In the "Close" position, the valve will close.
- b. Auto Control: An Open-Auto-Close switch shall be provided for each valve on the EBS Flushing System Control Panel. In the "Auto" position, the valve will open and close based on a combination of timers housed within the control panel. The timers shall be preset to produce the times listed below, all of which shall be adjustable.
 - 1) Time for valves to remain open: 90 minutes.
 - 2) Duration between valve openings: 15 days.
- c. Solenoid valves for the EBS Flushing System shall be designed to fail to the close position, upon loss of power.

-- END OF SECTION --

SECTION 13801

REHABILITATION OF VENTURI METERS

PART 1 GENERAL

1.1 DESCRIPTION

1.1.1 Scope:

1.1.1.1 Contractor shall furnish all labor, materials, and equipment and perform all operations necessary to rehabilitate the following venturi insert meters:

- a. 30" West Filter Master Backwash Venturi meter.
- b. 8" West Filter Master Surface Wash Venturi meter.
- c. 30" East Filter Master Backwash Venturi meter.
- d. 8" East Filter Master Surface Wash Venturi meter.

1.1.1.2 The following rehabilitation work items shall be included in Unit Price Item 001:

- a. Removal and Cleaning.
- b. Field Inspection and Inspection Report Preparation.
- c. Field Installation and Calibration.
- d. Operation and Maintenance Manual Preparation.

1.1.1.3 The following rehabilitation work items shall, when directed by the Contracting Officer's Representative, be paid for by means of a Change Order:

- a. On-Site Rehabilitation.
- b. Off-Site Rehabilitation.
- c. New Venturi Meter Insert.

1.1.1.4 Contractor shall submit copies of the Inspection Reports to the Contracting Officer. The Contracting Officer will direct the Contractor on which rehabilitation option to perform.

1.2 QUALITY CONTROL

1.2.1 Venturi Meter Inspector

The Contractor shall furnish the services of an independent consultant or qualified representative of a Rehabilitation Provider to inspect the venturi meter for potential rehabilitation. The Venturi Meter Inspector shall have at least 10 years experience in the design, fabrication, testing and

execution of rehabilitation work on venturi meters of similar size and design.

1.2.2 Rehabilitation Provider

The Contractor shall furnish the services of a Rehabilitation Provider to provide venturi meter rehabilitation work as specified herein. The Rehabilitation Provider shall be a manufacturer of venturi meters and have at least 20 years experience in the design, fabrication, testing and execution of rehabilitation work on venturi meters of similar size and design.

1.2.3 Venturi Meter Calibrator

The Contractor shall furnish the services of a qualified representative of a Rehabilitation Provider to calibrate the re-installed, rehabilitated venturi meter. The Venturi Meter Calibrator shall have at least 10 years experience in the calibration of venturi meters of similar size and design.

1.3 SUBMITTALS

Governmental approval is required for submittals with a "GA" designation; submittals having a "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES.

SD-01 Data

Venturi Meter Inspector; FIO.

The name and qualifications of the Venturi Meter Inspector.

Rehabilitation Provider; FIO.

The name and qualifications of the Rehabilitation Provider.

Venturi Meter Calibrator; FIO.

The name and qualifications of the Venturi Meter Calibrator.

SD-09 Reports

Inspection Report; FIO.

Certified Calibration Report; FIO.

Installation Certification; FIO.

PART 2 PRODUCTS NOT APPLICABLE

PART 3 EXECUTION

3.1 REMOVAL AND CLEANING

3.1.1 Contractor shall provide all equipment, materials and labor to disassemble piping, remove venturi meter inserts for on-site inspection, provide spacer rings, spool pieces or other items required to reassemble piping and place the pipeline back in service without the venturis in place. Refer to Section 01005 for shutdown requirements.

3.1.2 Contractor shall clean the venturi meter inserts for inspection, as directed by the Venturi Meter Inspector.

3.2 FIELD INSPECTION AND INSPECTION REPORT PREPARATION

3.2.1 Each venturi meter insert shall be field inspected by the Venturi Meter Inspector. This evaluation shall include both an internal and external inspection of the venturi meter.

3.2.2 Inspection Report: Venturi Meter Inspector shall prepare an Inspection Report for each venturi meter. The following information shall be included in this report:

3.2.2.1 Inspection findings.

3.2.2.2 Cost and time options for performing the rehabilitation work as follows:

- a. On-Site Rehabilitation: Field rehabilitation (if possible) and under the direction and full responsibility of the Rehabilitation Provider. The Rehabilitation Provider shall provide the services of a Venturi Meter Rehabilitation Supervisor to supervise field rehabilitation of the venturi meters. The Venturi Meter Rehabilitation Supervisor shall be a qualified representative of the Rehabilitation Provider, and shall have a minimum of 5 years experience in supervision of venturi meter rehabilitation.
- b. Off-Site Rehabilitation: Shipment of the venturi meters to a re-manufacturing facility to include rehabilitation of the venturi meters. Rehabilitation Provider shall assume full responsibility associated with the shipment and re-working of the venturi meters.
- c. New Venturi Meter Insert: Report shall also include option for providing a new venturi insert meter of similar size, and designed for intended service.

3.2.2.3 Each rehabilitation option, listed above, shall also include the following:

- a. A summary of rehabilitation work items recommended to be performed.
- b. An estimate of the installed accuracy of rate of flow measurement following rehabilitation.

- c. List of any limitations relative to in-service reliability following rehabilitation.
- d. An estimate of rehabilitated meter's extended life expectancy.
- e. List of any concerns with the proposed rehabilitation work.

3.3 ON-SITE REHABILITATION

3.3.1 If the Contracting Officer selects this rehabilitation option, the Rehabilitation Provider shall submit detailed written procedures to the Contracting Officer. Included with each procedure, the Rehabilitation Provider shall detail all materials that will be required.

3.3.2 Procedures shall detail the following major items, as they may apply:

3.3.2.1 Description of the proper environment within which rehabilitation work should be executed.

3.3.2.2 Environmental safeguards concerning contaminated and hazardous materials handling.

3.3.2.3 Interior and exterior cleaning.

3.3.2.4 Preparatory work prior to coating.

3.3.2.5 Polishing and buffing procedures.

3.3.2.6 Interior and exterior primer and finish coating.

3.3.2.7 Inspection of critical cross sections and matters related to their integrity.

3.3.2.8 Final inspection.

3.3.3 Contractor shall provide all materials, labor and equipment necessary to complete rehabilitation work as defined by Rehabilitation Provider's written procedures.

3.3.4 Contractor shall furnish the services of a qualified representative of the Rehabilitation Provider to supervise on-site rehabilitation of the venturi meters, as required. Venturi Meter Rehabilitation Supervisor shall have a minimum of 5 years experience in supervision of venturi meter rehabilitation.

3.4 OFF-SITE REHABILITATION

3.4.1 If the Contracting Officer selects this rehabilitation option, the Contractor shall crate the venturi meter and ship to a location specified by the Rehabilitation Provider.

3.4.2 Rehabilitation Provider shall perform rehabilitation work as recommended in Inspection Report. A new nameplate with current dimensional data shall be affixed to the top of the inlet flange. The nameplate shall indicate that the meter was rehabilitated, and the date that the rehabilitation work was completed.

3.4.3 Upon completion of rehabilitation work, Rehabilitation Provider shall ship the venturi meter back to the plant.

3.5 NEW VENTURI METER INSERT

3.5.1 If the Contracting Officer selects this rehabilitation option, the venturi meter manufacturer shall provide a new venturi meter insert as recommended by the manufacturer, and as approved by the Contracting Officer.

3.6 FIELD INSTALLATION AND CALIBRATION

3.6.1 The Rehabilitation Provider shall direct the Contractor's installation of the meter and submit an Installation Certification certifying that it has been properly installed to provide the stated accuracy.

3.6.2 The Contractor shall use new bolts, nut, washers and gaskets. Size and materials as recommended by the Rehabilitation Provider, and approved by the Contracting Officer.

3.6.2 Once the meter has been re-installed, the Venturi Meter Calibrator shall direct a field calibration of the secondary instrumentation of the differential pressure transmitter using a manometer. The test shall include zero and span check, and re-set as well as manometer readings over at least 6 flow rates.

3.6.3 Once the calibration of the transmitter is complete, a Certified Calibration Report shall be provided to the Contracting Officer.

3.7 OPERATION AND MAINTENANCE MANUAL PREPARATION

3.7.1 The Rehabilitation Provider shall submit three copies of a Operation and Maintenance Manual which includes the following components:

3.7.1.1 Product data sheets which provides important performance information.

3.7.1.2 Flow calculations based on the as-rehabilitated meter tolerances.

3.7.1.3 As-built drawing reflecting all critical tolerances.

3.7.1.4 Rate of flow versus differential curve and tabulation for the range of flowrates as determined by the Contracting Officer.

3.7.1.5 Statement of expected accuracy based on a performance testing, a review of actual installed piping conditions, and past experience.

3.7.1.6 Statement of expected life.

-- End of Section --